IIMT UNIVERSITY MEERUT
Transforming Education System, Transforming Lives
UGC Approved Section 2(f) & 12B
NAAC Accredited with A GRADE

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SCHOOL OF COMPUTER SCIENCE & APPLICATIONS

ACADEMIC HAND BOOK



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Ordinance & Academic Regulations
Bachelor of Computer Application (BCA)
(Academic Handbook 2025-26)

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1. PREAMBLE

As the technological enhancement and availability of technology to every person of world a huge demand of computer skilled professional is ample. In this world of opportunities, impact of higher education is so inevitable for getting desired guidance to secure, right kind of employment. It is compulsory to pursue higher related- education in the best institutes. In this direction major reforms are to opt Learning Outcomes-based Curriculum Framework (LOCF), specially, in the undergraduate education (UG) program, that ensure student centric, interactive and outcome-oriented goals, objectives and skill enhancement to acquire. LOCF along with National Education Policy (NEP) in this regard ensure uniform education fabric of standard and content delivery education all over the nation. This syllabus development is a step to ensure development of the undergraduates for both, academia and employability. Latest technical trends, industry standards, market needs, and interests of students, future expectations the need has been taken into consideration while developing the syllabus.

The LOCF inculcation is to build up a comprehensive course structure with detailed syllabus. This is an effort to develop a student centric framework where they are expected to have a concrete understanding of fundamentals of computer science along with the latest trends and techniques like Artificial Intelligence, Internet of Things (IoT), Machine Learning (ML) with advanced skill sets that include Mobile Application environment, Object Oriented Programming (OOPs) among many courses. Each course aims to present learning targets and objectives, and thus provide learning and teaching strategies, assessment and resources. The students shall be equipped with the latest trends in computer science, after completion of the programme

With this an education temple of nation should ensure an environment, which should be bias free, irrespective of cast, religion, races and sex difference and easily available to youths of the nation. The human value, ethics and environmental teaching is also introduced with this.

2. DEFINITIONSANDNOMENCLATURE

In these Regulations, unless the context otherwise requires:

1. "Programme" means Degree Programme like Bachelor of Computer Application (BCA). Hence, further BCA and BCA (Cloud and Cyber Security) will call BCA in this document.
2. "GPA" means Grade Point Average.
3. "Course" means a theory or practical subjects that are normally studied in a semester.
4. "VC, Vice-*Chancellor* of IIMT-University" means the Head of the University.
5. "Registrar" is the Head of all academic and General Administration of the University.
6. "Dean" means the authority of the school that is responsible for all academic activities of various programmes and implementation of relevant rules of these Regulations pertaining to the Academic Programmes.
7. "COE, Controller of Examinations" means the authority of the University who is responsible for all activities related to the University Examinations, publication of results, award of grade sheets and degrees.
8. "Dean – Student Welfare" is responsible for all student related activities including student discipline, extra and co–curricular activities, attendance and meetings with class representatives, Student Council and parent–teacher meeting.
9. "HoD" means the Head of the Department concerned.
10. "University" means IIMT-University, Meerut.
11. "TCH" means Total Contact Hours–refers to the teaching–learning periods.

12. "DEC" means Department Exam Committee.
13. "BoS" means Board of Studies.
14. "ACM" means Academic Council Meeting the highest authoritative body for approval for all Academic Policies.
15. "Class Coordinator" is a faculty of the class who takes care of the attendance, academic performance, and the general conduct of the students of that class.
16. "IA" is Internal Assessment which is assessed for every student for every course during the semester.
17. "ESE" is End Semester Examination conducted by the University at the End of the Semester for all the courses of that semester.
18. "UGC" means University Grants Commission.
19. "MHRD" means Ministry of Human Resource Development, Govt. of India.
20. "AICTE" means All India Council of Technical Education.
21. "HEI" means Higher Education Institutions.
22. "PRN" means Permanent Registration Number.
23. "CGPA" means Cumulative GPA.
24. "SGPA" means Semester GPA.
25. "NC" means Non-Credit.

3. VISION AND MISSION OF THE SCHOOL

VISION

To achieve heights in computer education domain by creating appropriate environment for students, faculties and staff with availability of latest technological infrastructure.

MISSION

1. To dissipate appropriate all types of practical and theoretical computer science knowledge to our young students.
2. Inculcate professional efficiency in the students for brighter career opportunity as per industry latest requirement.
3. To provide learning environment for students with our reputed academics partner in the field of computer science.
4. To prepare our student as an IT professional with full of ethics and human values.

4. PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: The graduates programs are designed to produce skill graduates who will be competent professionals in academics, industry and organizations of government and private sector.

PEO2: The pass out graduates will be able to handle the fast-changing world requirements and will become effective professionals.

PEO3: The successful Graduates will be a good team leader and will be able to lead the team to find optimal solutions and achieve expertise in their field or become entrepreneurs and play the leading roles in all types of organizations.

5. PROGRAM OUTCOMES (PO'S)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics,

natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. .

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

6. PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1: The graduates are proficient in fundamental principles and methods of Computer Science, Mathematical and Scientific reasoning and are able to:

- Apply fundamental concepts of integration, differentiation, vector calculus, probability & statistics, and discrete mathematics.
- Design, create & evaluate algorithms appropriate to specific problems.

PSO2: The graduates have understanding for:

- Demonstrate capability for computers, computer network and server environments and there troubleshooting.
- Capacity to handle cloud computing environment and solutions.
- Well defined knowledge for solving problems of security and threats in information knowledge domain.

7. ADMISSION

Hence, further BCA and BCA (Cloud and Cyber Security) will be called BCA in this document. The admission policy and procedure shall be decided from time to time by the

University based on the guidelines issued by the UGC/Ministry of Education, Government of India. Seats are also made available for Non-Resident Indians and foreign nationals, who satisfy the admission eligibility norms of the University as per the UGC Norms.

8. ELIGIBILITYIN ALL YEARS AS PER NEP (ENTRY)

8.1 Candidate should have passed "10+2" exam (recognized board) in any stream with at least 40% in aggregate.

8.2 Admission will be based on academic record.

8.3 The Academic Council shall have power to amend or repeal the eligibility criteria laid down at clause 8.1 & 8.2, if required.

9. CURRICULUM

The curriculum for Bachelor of Computer Application Programme is designed to have minimum and maximum credits as per the scheme of 120-160 credits that are distributed across six semesters of study for the award of degree.

10. MEDIUM OF INSTRUCTION

The medium of instruction is ENGLISH for all courses, examinations, seminar presentations and project reports.

11. CHOICE BASED CREDIT SYSTEM (CBCS)/ LOCF/ OBE

11.1 The three-year curriculum has been divided into six semesters. Semester Ist to VIth shall include lectures, tutorials, practical, seminars and project work as defined in the scheme of instruction and examination issued by the University from time to time.

11.2 The curriculum will be also including such other curricular, co-curricular and extra- curricular activities as may be prescribed by the University from time to time. Credit System BCA programme will have a curriculum in which every course will be assigned certain credits reflecting its weight and contact periods per week, as given below:

1 Lecture period (L) per week	=	1 Credit
1 Tutorial period (T) per week	=	1 Credit
1 Practical period (P) per week	=	0.5 Credit

In addition to theory and laboratory courses there may be other courses such as seminar, project etc., which will be assigned credits as per their contribution in the programme without regard to contact periods.

11.3 Minimum Credit Requirements

The minimum credit required for award of a BCA degree is 120**.** This is normally divided into theory courses, tutorials, laboratory courses, seminars and projects in duration of six semesters. The credits are distributed semester wise as shown in the structure and syllabus manual of the programme. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are

expected to follow the semester wise schedule of courses given in the syllabus manual of the programme.

11.4 Course Categories

Under CBCS, the degree programme will consist of the following categories of courses as per following table:

Table 11.4 - Distribution of Credits (Evaluation Scheme)

S. No.	Category	
1.	Core Course (Theory)-CC	**As per Format 1 & 2 of CBCS**
2.	Core Course (Practical)-CC(P)	
3.	Discipline Specific Elective (Theory)- DSE	
4.	Generic Elective (Theory)-GE	
5.	Ability Enhancement Compulsory Courses-AECC	
6.	Skill Enhancement Courses-SEC	
7.	Research Project (RP)	

11.5 Curriculum Structure

The curriculum for BCA will contain a listing of all courses, with each course having a course category, course number, course title, number of contact periods per week, number of credits assigned, and the marks assigned to various components of evaluation.

11.6 Approval of the Curriculum

The curriculum for BCA programme will be prepared by the department concerned and will be approved by the Board of Studies of the department. The Academic Council for final approval and then the curriculum will be implemented. Same procedure shall be used for any modification in the curriculum.

12. REGISTRATION FOR A COURSE IN A SEMESTER

A student will be eligible for registration of courses only if he/she satisfies the regulation (progression), and has cleared all dues to the University, Hostel and Library up to the end of the previous semester if student is not debarred from enrolment on disciplinary grounds.

The university follows a flexible Choice Based Credit System and slot-based table. Accordingly, the students shall be given the option for selecting their courses, credits, teachers, slots and create their timetable. The student is given the option of selecting the number of credits to undergo in a semester, subject to the curriculum requirements.

Except for the first-year courses, registration for a semester will be done during a specified week before the start of the semester as per the academic calendar.

Late registration/enrolment will be permitted by the Dean of the School for genuine cases, on recommendation by the Head of the respective department, with a late fee as decided from time to time.

The student shall make the choice of course in consultation with the Class Coordinator and as stipulated from time to time.

Students shall have to pay additional fee as prescribed, for registering in certain elective courses under Generic Electives courses offered by certain specific departments and for higher level Foreign Languages, as decided from time to time.

13. ATTENDENCE

The faculty handling a course must finalize the attendance, three calendar days before the last instructional day of the course and submit to the HoD through the class teacher.

13.1 Condonation of Medical Cases

a. A student with less than 75% attendance (Total Contact Hours -"TCH") in any course, will not be permitted to appear for the end-semester examination in that course, irrespective of the reason for the shortfall of the attendance. The student is however permitted to avail Academic Leave up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD. After the event, the student should submit the relevant documents for proof to the HoD for approval of the Academic Leave.

b. The remaining 25% allowance in attendance is given to account for activities under NCC / NSS / Cultural / Sports/ Minor Medical exigencies etc.

c. Students under "CO (Carry Over)" category in any course shall attend the immediately following Summer/Winter course. The detailed schedule of the Summer/Winter courses offered in every semester will be announced during the end of that semester. The students who have obtained "CO (Carry Over)" have to select their appropriate slots and courses, optimally to attend the courses.

13.2 Additional Condonation

Additional Condonation may be considered in rare and genuine cases which includes, approved leave for attending select NCC / Sports Camps, cases requiring prolonged medical treatment and critical illness involving hospitalization. For such select NCC / Sports Camps prior permission for leave shall be obtained by the respective Dean / Director of sports from the designated authority, before deputing the students.

For medical cases, submission of complete medical history and records with prior information from the parent / guardian to Dean (Students Welfare) DSW is mandatory. The assessment of such cases will be done by the attendance sub – committee on the merit of the case and put-up recommendations to the Vice – Chancellor. Such condonation is permitted only twice for a student in the entire duration of the programme.

The Vice-Chancellor, based on the recommendation of the attendance sub-committee may then give condonation of attendance, only if the Vice-Chancellor deems it fit and deserving. But in any case, the condonation cannot exceed 10%.

14. ASSESSMENT PROCEDURE

14.1 Internal Assessment (IA) – 25 Marks & External Assessment (EA) - 75 Marks

14.2 Practical Assessment (as per format 1 and 2)

15. RESEARCH PROJECT/SEMESTER PROJECT – ASSESSMENT CRITERIA

The general guidelines for assessment of Project are given in Table 15.1

Table15.1: Assessment pattern for Research Project / Semester Project

S. No.	Review / Examination Scheme	Broad Guidelines	Weightage
1	First Review	Concept	10%
2	Second Review	Design	10%
3	Third Review	Experiment/Analysis	20%
4	Final Review/ESM	Project report and Viva – Voce, Results and Conclusion	60%

16. INTERNSHIP – RESEARCH/INDUSTRIAL INTERNSHIP

A student has to compulsorily attend summer internship at the end of 4th semester for a minimum period of 30 days. In lieu of Summer-Winter internship, the student is permitted to register for undertaking project work under a faculty of the University and carry out the project for minimum period of 30 days. In both the cases, the internship report in the prescribed format duly certified by the faculty in-charge shall be submitted to the HOD. The evaluation will be done through presentation and viva. The course will have a weight age as defined in the respective curriculum.

For the final year project and viva-voce end semester examination, the student shall submit a project report in the prescribed format issued by the University. The reviews will be conducted by a committee constituted by the HOD. The end semester assessment will be based on the project report and a viva on the project conducted by a committee constituted by controller of examination. This may include an external expert.

17. FOR NON-CGPA COURSES/AUDIT COURSES

The Assessment will be done based on the respective assessment as per rubrics issued by the HOD.

A student securing less than the minimum specified internal assessment marks in any course will not be permitted to appear for the end-semester examination in that course and will be graded under "CO (Carry Over)" category for that course. This will be denoted in the grade sheet as "CO (Carry Over)", till the course is successfully completed in the subsequent semester(s).

18. CREDIT WEIGHTAGE

Credits are the weightage, assigned to the courses based on the following general pattern:

One Hour	1 credits
Two Hour Practical	0.5 credits

19. MAXIMUM DURATION OF THE PROGRAMME/ PROMOTION POLICY

A student may complete the programme at a slower pace than the regular pace, but in any case, in not more than **N+2 years**.

A student completing the degree programmes in the extended period will not be eligible for university ranking.

20. MAXIMUM GAPS BETWEEN SEMESTER/YEAR

A student may be permitted by the Vice-Chancellor to withdraw from the entire programme for a maximum of two semesters for reasons of ill health, start – up venture or other valid reasons as recommended by a committee consisting of Head of Department, Dean of School, and Dean

(Student Welfare).

21. CREDIT SYSTEM & GRADING CGPA/SGPA

Introduction

IIMT University implemented the UGC guidelines to implement of the choice-based credit system with a view to offer student's choice of courses within a programme with a flexibility to complete the programme by earning credits at a pace decided by the students themselves. The system allowed students to choose inter-disciplinary, intra-disciplinary courses according to their learning needs, interest and aptitude. It was considered as a cafeteria approach and was expected to provide mobility to students.

21.1 Credit System

As per the current credit system practiced in institutions needs comprehensive reforms as they offer very little flexibility, choice and are less learner centric. Degrees offered today are more self-contained focusing on a specialization area and depend a lot on knowledge available with the faculty from the department only. Though the most requisite credit system does exist, wherein students are given a wide choice and flexibility, these exist as small islands in the vast ocean of thousands of educational institutes in India. In such institutions, the curriculum is frequently designed which is learner centric and offering a wide specialization area for students to pick and choose courses from.

The institutions shall make attempts wherein the design of the credit system and the teaching and evaluation modes shall be the responsibility of individual course teachers. The students should have the freedom to opt for courses from other specializations and not just from their core specialization. For this there has to be stronger collaborations between departments of the University and outside.

21.2 Grading System

Most institutions follow the absolute grading system which is a simple procedure wherein the marks obtained by students correspond to a specific grade and grade point. It reflects the individual performance in a particular subject without any reference to the group/class. The absolute grading system has limitations and may be susceptible to some inconsistencies.

The relative grading system on the other hand provides relative performance of a student to a group/class wherein the student is ranked in a group/class on basis of relative level of achievement. In this system decisions are made in advance by the faculty members as to what proportion of students would be awarded a particular grade on the basis of their relative performance and which is done by assigning grades on basis of a normal curve. This facilitates comparative performance and eliminates negative effect of pass or fail.

Relative grading system may be used if the number of students registered for the course is at least 30. For a class of smaller size, an absolute grading scheme may be used. The statistical method may be used with adjustments to calculate the mean (M), median (Md) and standard deviation (SD) of the total marks (TM) obtained by the students registered for the course. If the mean and median coincide, the mean may be used for further computations, otherwise the median may be used. If suppose the mean is used, then the letter grades may be awarded based on the ranges specified in table below:

A grading system as shown in given table-

Table 21.2: Grading system

Letter Grade	Range
A+	TM>M+1.75SD
A	M+1.25 SD ≤TM<M+1.75SD
B+	M+0.75 SD ≤TM<M+1.25SD
B	M+0.25 SD ≤ TM < M+0.75 SD
C+	M-0.25 SD ≤ TM < M-0.25 SD
C	M-0.75 SD ≤ TM < M-0.25 SD
D+	M-1.25 SD ≤ TM < M-0.75 SD
D	M-1.75 SD ≤ TM < M-1.25 SD
E+	M-2.0 SD ≤ TM < M-1.75 SD
E	M-2.25 SD ≤ TM < M-2.0 SD
F	M-2.25 SD > TM
CO	Carry Over (Summer/Winter) due to Attendance deficiency (between 40% and 75%) and/or I. Lack of minimum IA marks as specified in clause 10.0 Table 3.
RA	Repeat the course due to (i) Lack of minimum attendance (below 40%) in regular course.
--	DETAINED "RC" or "RA" or both in all registered theory courses of a semester. The student is detained and has to repeat the entire semester. Clause 12.3

Letter grades may be improved based on the following scheme: Use the table above to determine grade boundaries. Look for natural gaps in the neighborhood of grade boundaries. Choose the largest gap in the neighborhood and make this as the grade boundary.
An 'E', 'E+' and 'F' grade may not be a purely relative grade. These may be assigned on the following basis:

- A minimum, say 30/100, may be set as pass marks for the course. A fail grade may then be awarded only if the Total Marks for the course are less than 30. Otherwise, the students may be awarded the Just Pass Grade D.

- A failure grade may be awarded to students whose marks are below the prescribed minimum even if the table above leads to a pass grade.

Similarly, a lower limit may be set for the A grade also, for instance greater than or equal to 86. Students not achieving the prescribed minimum may be awarded a lower letter grade even if the table above indicates otherwise. A pass grade may be made mandatory for both internal as well as external examinations in the case of a separate internal and external assessment,

a. Internal and External marks may be summed up with appropriate weightage to compute a total out of 100 marks. The letter grade may be assigned on this computed total.
b. Internal and external marks may be graded separately and then the assigned grade points may be used, with appropriate weightage, to compute a final grade point and letter grade.

Grading in the case of Re-evaluations, Retests and Remedial Examinations may be based on the following guidelines:

a. The ranges of marks once computed for awarding letter grades the first time, called the First Distribution (FD), will not be modified.
b. If a re-evaluation leads to a change in marks, then FD will be used to award an appropriate letter grade.

c. A retest may be permitted, if
   i. A student gets a letter grade of E+ or E. In this case, irrespective of the marks obtained, at most D grade may be awarded.
   ii. A student is unable to complete course requirements because of certified illness or tragedy. In this case FD will be used to award an appropriate letter grade.

The use of relative grading system may be recommended in autonomous institutions, institutes of national importance and institutions with high ranking. The results of the relative grading system may be shared by such institutions later with other interested institutions to implement the same.

21.3 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i "and the grade points Pi earned for that course taken over all courses "i" registered and successfully completed by the student to the sum of Ci for all "i". That is,

$$GPA = \frac{\sum_i C_i P_i}{\sum_i C_i}$$

CGPA will be calculated in a similar manner, in any semester, considering all the courses enrolled from the first semester onwards.

21.2 The Grade card will not include the computation of GPA and CGPA for courses with letter grade CO, RC and U until those grades are converted to the regular grades.

21.3 A course successfully completed cannot be repeated.

Grade Sheet

Letter grade

Based on the performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and corresponding grade points are given in **Table 8**. A student is considered to have completed a course successfully and earned credits if he/she secures a letter grade other than F, CO, RA in that course.

After results are declared, grade sheet will be issued to each student which will contain the following details:

a. Program and discipline for which the student has enrolled.
b. Semester of registration.
c. The course code, name of the course, category of course and the credits for each course registered in that semester
d. The letter grade obtained in each course
e. Semester Grade Point Average (GPA)
f. The total number of credits earned by the student up to the end of that semester in each of the course categories.
g. The Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.
h. Credits earned under Non-CGPA courses.

22. CLASS /DIVISION

22.1 Classification is based on CGPA and is as follows:

CGPA ≥ 8.0 : **First Class with distinction**
6.5 ≤ CGPA <8.0 : **First Class**
5.0 ≤ CGPA <6.5 : **Second Class**

22.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance with effect from II semester, within the minimum duration of the programme.

ii) The award of 'First Class is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses within 3 years for Bachelor of Computer Application.

(iii) The period of authorized break of the programme (vide clause 11.0) will not be (counted for the purpose of the above classification.

23. TRANSFER OF CREDITS/ACEDEMIC CREDIT BANK

23.1 "Credit-transfer" means the mechanism by which the eligible HEIs registered with ABC are able to receive or provide prescribed 'credits' to individual registered ABC account in adherence to the UGC credit norms for the 'course/s' registered by the desirous students in any eligible higher education institution within India

23.2. Within the broad framework of these regulations, the Academic Council, based on the recommendation of the Credit Transfer Committee so constituted may permit students to transfer part of the credit earned in other approved Universities of repute & status in the India or abroad.

23.3 The Academic Council may also approve admission of students who have completed a portion of course work in another approved Institute of repute under Multiple entry & Exit system, based on the recommendation of the credit transfer committee on a case-to-case basis.

23.4 Students who have completed coursework, at least first year, at some university other than the university to which transfer is to be sought, may request for transfer of admission to this university. A student may be granted admission only through an admission process that will follow the same policy as for fresh admissions. However, a uniform credit system must be followed by all universities to effect transfer of credits.

23.5 Credit Transfer request can be submitted only after the student has been admitted in the concerned program and the following conditions are met:

University Grants Commission initiated the concept of National Academic Credit Bank (NAC-Bank) which will be a digital / virtual / online entity to be established and managed by UGC. The main objective of the NAC-Bank would be to facilitate student mobility across the education system wherein the credits can be accumulated and be used at alter point of time for the requirements of partial fulfillment of a degree program.

i. The course work has been completed at a UGC approved and accredited University through fulltime formal learning mode.

ii. The university accreditation grade/ ranking is not lower than that of the university to which the transfer is sought.
iii. The courses prescribe to the common minimum syllabus under UGC CBCS system.
iv. The letter grade obtained in the courses is "B" or better.
v. The number of credits to be transferred does not exceed the prescribed limit.
vi. The program in question must have a similar credit system, in particular, modular or semester and the same numeric and letter grading system along with common meaning of the term "credit" in numerical terms.

The aspect of shelf life of courses needs to be considered while accepting credits as obsolescence of knowledge of certain field in terms of its current relevance needs to be investigated. The time elapsed between successful completion of certain courses of the program and the admission to which program transfer is sought needs to be considered. The maximum number of credit points that may be considered under a credit transfer needs to be specified. Contextual variables such as teaching-learning approach adopted, learning facilities offered, use of evaluation modes may also be considered while preparing the credit transfer policy.

Moderation

Moderation of assessment is an organized procedure which ensures use of valid assessment material and consistent application of criteria, to provide fair academic judgment and reliable outcome in the form of marks or grades. It assures appropriate designing and implementation of assessment activities along with generation of valid and reliable results.

Integration of moderation process with assessment system is imperative for the development of academic quality in higher educational institutions as:

- It addresses any difference in individual judgments of different evaluators.
- It ensures that all achievements in the form of marks and grades across courses reflect achievement of same level of standard.
- It is also carried out to develop a common understanding of the standards and criteria and to recognize performance which demonstrates that standard or fulfils those criteria.

Moderation may be conducted in case there are large number of fail grades or high grades, or when large numbers of students who have received the same grade or clustering of students on letter grades, or when there are discrepancies between grades allocated to individual students in different courses, or to find out the difficulty level of the question paper or whether the assessments modes used cover the entire syllabus or not.

Applicability

Moderation will be made applicable to both external and internal modes of assessment. All programs and courses will indicate, as part of their statements on assessment, arrangements for the moderation of assessed work. This can be done through formulation of a moderation policy and implemented across all programs and courses of instruction and delivery. The time frame for the moderation will be linked with the time frame for assessment.

In the event moderation is triggered, an evaluation will begin with a discussion on the following (though not exhaustive) lines:

a. What are the rubrics used for each of the different types of assessment in the course? Is a standardized/ prescribed rubric used or has the instructor developed his/ her own rubric. If the instructor is using a personally framed rubric, or if there is no identified rubric, then how does the assessment map to learning outcomes?

b. The difficulty level of the questions included in the assessments, i.e., is the difficulty level on the extremes, very easy or very hard.
c. The manner of awarding marks, i.e., has the correction been at the extremes, liberal or tough.

Each department will establish a committee and designate roles and responsibilities at different levels for smooth working of the moderation process. In order to maintain neutrality, it will be ensured that moderator should not be the assessor. Staff members will be trained professionally in assessment techniques and moderation procedures. All assessment material produced by learner including examination sheets, assignments, project reports, research reports etc. will be examined.

Institutions will be encouraged to make the moderation process online. In this system, assessment plans, moderation plans, assessment tools, samples of which may be submitted online. Moderation reports will be generated online so that progress can be tracked and submitted to the COE after the approval of Dean and HOD. The moderation will not be restricted to just assessment but also include moderation of content and assessment design.

24. CHANGE OF DISCIPLINE

"Academic Flexibility" is the provision for innovative and interchangeable curricular structures to enable creative combinations of Courses/Programmes in Disciplines of study leading to Degree/Diploma/PG Diploma/Certificate of Study offering multiple entry and multiple exit facilities in tune with National Education Policy-2020, while removing the rigid curricular boundaries and creating new possibilities of life-long learning.

25. USE OF TECNOLOGICAL INTERVENTIONS

With the proliferation of different types of access devices, especially mobile access devices, technology has the potential to augment traditional classroom practices and revolutionize learning and evaluation methods. Technology, in fact can be an important driver to enable lifelong learning. Learning and engagement of students is facilitated by use of technology through several modes such as synchronous learning, semi-synchronous learning, blended learning, collaborative learning, flipped classroom etc. MOOC's especially provided through SWAYAM are a window of opportunity for lifelong learning and are offered through technology-based platforms. Learning management systems (LMS) may be used by institutions to integrate the entire teaching, learning and evaluation process. The Learning Management System may be used by institutions to deliver academic content in blended form and to assess learning through thesis, assignments etc. Open-source learning management systems such as *Moodle, Edmodo* may be used for posting content in the form of videos, audios, e-learning modules, live class sessions etc. Use of plagiarism detection software will be highly recommended to check originality of the content.

In the conduct of examinations, universities face tremendous challenges such as need for trained manpower, distribution of question paper without delays and errors, delays in evaluation of answer scripts, lack of infrastructure to conduct examinations at a large scale, non-availability of faculty members for assessment, security issues faced during paper setting and paper distribution, tampering of certificates and answer scripts etc.

For a typical examination department of an institution will be an autonomous body right from registration of student to convocation through an integrated system. In fact, steps must be taken to implement a complete examination management system that considers the complete life cycle of examination process. The use of technology will reduce dependency on human

intervention and be error free. The following functions will be automated:

i. Registration of students and generating unique PRN,
ii. Filling up of examination form,
iii. Generation of seat numbers and admit cards/hall tickets,
iv. Preparation of list of paper setter,
v. Use of question bank system to draw question sets, question paper generation,
vi. Online distribution of question papers on the day of examination with system of encryption,
vii. Barcode system for answer books (this will eliminate issues related to errors, avoid malpractices etc.),
viii. Digitization of answer scripts and onscreen evaluation of answer sheets,
ix. Tracking of student's performance,
x. Marks submission through online software,
xi. Viewing of result through online system,
xii. Online verification and revaluation system,
xiii. Digitization of certificates and mark sheets (to avoid tampering and easy retrieval),
xiv. Certificate authentication system,
xv. Submission of various other applications through online system.

The above will lead to conduct of functions of the examination system in an efficient and transparent manner and timely availability of information to students.

26. STUDENT DISCIPLINE

Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige reputation of the University and School.

27. STUDENT WELFARE

Any act of indiscipline of a student reported to the Dean (Students Welfare) and Head of the Department will be referred to a Discipline Committee constituted for the purpose. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also authorize the Dean (Students Welfare) to recommend to the Vice-Chancellor for the implementation of the decision. The student concerned may appeal to the Vice-Chancellor, whose decision will be the final.

28. RAGGING

Ragging in any form is a criminal and nonbailable offence in our country. The current State and Central legislations provide string Ent punishments including imprisonment. Once the involvement of a student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the University, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student at the University, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

29. POWER TO MODIFY

Not with standing all that has been stated above, the Academic Council is vested with powers to modify any or all the above regulations from time to time, if required, subject to the approval by the Board of Studies and final approval by Vice-Chancellor.

30. EXIT POINT

Exit point will be governed as per format 1 and format 2.

31. NC/CREDIT COURSE

For non-credit courses 'Satisfactory' or 'Unsatisfactory' shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Evaluation Scheme

Bachelors in Computer Application (BCA)

Bachelors in Computer Application (BCA) Year: I / Semester: I										
S.No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	25BCA-101	Problem solving techniques using 'C' Language	C1	3	0	0	25	75	100	3
2	24BCA-102	Mathematics for Computing-I	C2	4	0	0	25	75	100	4
3	24BCA-103	Basics of Computers and Recent Trends	C3	3	0	0	25	75	100	3
4	24BCA-104-1 24BCA-104-2 24BCA-104-3 24BCA-104-4	**Select Any One** 1. ERP 2. M-Commerce 3. Feature Engineering. 4. Basics of Data Analytics using Spread Sheet.	DSE 1	4	0	0	25	75	100	4
5	NHU-111	English Communication	AECC 1	3	0	0	25	75	100	3
6	24BCA-105	Office Automation Tools	SEC 1	2	0	0	25	75	100	2
7	24BCA-105P	Office Automation Tools Lab	SEC 1	0	0	2	25	25	50	1
8	IEMM-402	Indian Ethos and Modern Management	VAC 1	2	0	0	25	75	100	2
9	25BCA-106P	Problem solving techniques using 'C' Language Lab	C1 Lab	0	0	2	25	25	50	1
10	24BCA-107P	Basics of Computers and Recent Trends Lab	C3 Lab	0	0	2	25	25	50	1
11	SPT-PC-111	Sports		0	0	2	15	35	50	NC
		Grand Total		**21**	**0**	**8**	**265**	**635**	**900**	**24**
C1 - Core Course 1, C2 - Core Course 2, C3 – Core Course 3, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										

Bachelors in Computer Application (BCA) Year: I / Semester: II										
S.No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	24BCA-201	Advance 'C' Programming	C4	3	0	0	25	75	100	3
2	24BCA-202	Mathematics for Computing-II	C5	4	0	0	25	75	100	4
3	24BCA-203	Digital Electronics and Computer System Architecture	C6	3	0	0	25	75	100	3
4	24BCA-204-1 24BCA-204-2 24BCA-204-3 24BCA-204-4	**Select Any One** 1. Digital Marketing 2. Information System 3. Cloud Computing 4. Artificial Intelligence	DSE 2	4	0	0	25	75	100	4
5	NHU-NPR-112	Environment and Ecology	AECC2	4	0	0	25	75	100	4
6	NHU-NPR-112P	Environment and Ecology Lab	AECC2 Lab	0	0	2	25	25	50	1
7	24BCA-205	IPR/E&I will be run by NPTEL, registration will start in January of every year	SEC2	0	0	4	0	0	0	2
8	Course code to be provided from IIMTU other Schools	Generic Elective (To be opted from other Schools of IIMTU)	GE 1	4	0	0	25	75	100	4
9	24BCA-206P	Advance 'C' Programming Lab	C4 Lab	0	0	2	25	25	50	1
10	24BCA-207P	Digital Electronics and Computer System Architecture Lab	C6 Lab	0	0	2	25	25	50	1
11	SPT-PC-211	Sports		0	0	2	15	35	50	1
		Grand Total		**22**	**0**	**12**	**240**	**560**	**800**	**28**
"C1 - Core Course 1, C2 - Core Course 2, C3 – Core Course 3, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC-Skill Enhancement Course, RP – Research Project VAC- Value Added Course IPR: Intellectual Property Rights, E&I : Entrepreneurship and Innovation.										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										

Bachelors in Computer Application (BCA) Year: II / Semester: III										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	25BCA-301	Data Structure and Algorithms using 'C'	C7	3	0	0	25	75	100	3
2	25BCA-302	Operating Systems	C8	3	0	0	25	75	100	3
3	25BCA-303	Database Management System	C9	3	0	0	25	75	100	3
4	25BCA-304-1 25BCA-304-2	**Select Any One** 1. Block Chain Technology 2. Data Mining and Data Warehousing	DSE-3	4	0	0	25	75	100	4
5	UVE-401	Universal Human values & Professional Ethics	AECC-3	3	0	0	25	75	100	3
6	25BCA-305	R-Programming	SEC-3	2	0	0	25	75	100	2
7	25BCA-306	Cyber Security	VAC-2	3	0	0	25	75	100	3
8	25BCA-301P	Data Structure and Algorithms using 'C' Lab	C7 Lab	0	0	2	25	25	50	1
9	25BCA-302P	Operating Systems Lab	C8 Lab	0	0	2	25	25	50	1
10	25BCA-303P	Database Management System Lab	C9 Lab	0	0	2	25	25	50	1
11	25BCA-305P	R-Programming Lab	SEC-3	0	0	2	25	25	50	1
12	Course Code to be given by the School of IIMTU whose Generic Elective will run.	Course name to be given by the School of IIMTU whose Generic Elective will be chosen.	GE-2	4	0	0	0	0	0	4
13	SPT-PC-311	Sports		0	0	2	15	35	50	NC
		Grand Total		25	0	10	290	660	950	29
"C1 - Core Course 1, C2 - Core Course 2, C3 – Core Course 3, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										

Bachelors in Computer Application (BCA) Year: II / Semester: IV										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	25BCA-401	OOPs using Java	C10	3	0	0	25	75	100	3
2	25BCA-402	Software Engineering	C11	3	0	0	25	75	100	3
3	25BCA-403	Computer Graphics	C12	3	0	0	25	75	100	3
4	25BCA-404-1 25BCA-404-2 25BCA-404-3 25BCA-404-4	**Select Any One** 1.IOT 2.Computer Based Numerical and Statistical Techniques 3. Introduction to Machine Learning 4. Introduction to Artificial Intelligence	DSE 4	4	0	0	25	75	100	4
5	25BCA-405	Professional Skills	AECC4	3	0	0	25	75	100	3
6	25BCA-406	IPR/E&I Through NPTEL	SEC4	0	0	4	0	0	0	2
7	Course code to be provided from IIMTU other Schools	Generic Elective (To be opted from other Schools of IIMTU)	GE 3	4	0	0	0	0	0	4
8	25BCA-401P	OOPs using Java Lab	C10 Lab	0	0	2	25	25	50	1
9	25BCA-402P	Software Engineering	C11 Lab	0	0	2	25	25	50	1
10	25BCA-403P	Computer Graphics Lab	C12 Lab	0	0	2	25	25	50	1
11	SPT-PC-411	Sports		0	0	2	15	35	50	1
		Grand Total		**20**	**0**	**12**	**215**	**485**	**700**	**26**
"C1 - Core Course 1, C2 - Core Course 2, C3 – Core Course 3, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course IPR : Intellectual Property Rights , E&I : Entrepreneurship and Innovation										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										

Bachelors in Computer Application (BCA) Year: III / Semester: V										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCA-NEP-501	Design and Analysis of Algorithms	C1	4	0	0	25	75	100	4
2	BCA-NEP-502	Web Technologies	C2	4	0	0	25	75	100	4
3	BCA-NEP-503	1. Data Communication Network 2. ERP 3. Big Data	DSE	4	0	0	25	75	100	4
4	RP-1 AUDIT	Research Project– I[@]	AUDIT	0	0	0	50	0	50	NC
5	BCA-NEP-IP-I	Internship	Industrial Internship (Mandatory)	0	0	10	50	50	100	5
6	BCA-NEP-504P	Design and Analysis of Algorithms Lab	CORE LAB 1	0	0	4	25	25	50	2
7	BCA-NEP-505P	Web Technologies Lab	CORE LAB 2	0	0	4	25	25	50	2
		Grand Total		**12**	**0**	**18**	**225**	**325**	**500**	**21**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										
NOTE: @RESEARCH PROJECT – II is a Noncredit course (Audit Courses) and Student needs to qualify it but the marks will not be added in total marks.										

Bachelors in Computer Application (BCA) Year: III / Semester: VI											
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCA-NEP-601	Cyber Security	C1	4	0	0	25	75	100	4
2	BCA-NEP-602	Artificial Intelligence	C2	4	0	0	25	75	100	4
3	BCA-NEP-603	1. Mobile Computing 2. E-Commerce 3. Real Time System	DSE	4	0	0	25	75	100	4
4	BCA-NEP-IP-II	Industrial Project	Industrial Project	0	0	10	100	0	100	5
5	BCA-NEP-605P	Cyber Security Lab	CORE LAB 1	0	0	4	25	25	50	2
6	BCA-NEP-606P	AI Lab	CORE LAB 2	0	0	4	25	25	50	2
7	*Code will be decided by parent department	GE-III (To be opted by the students as per the given electives in the list attached)	GE (Mandatory)	4	0	0	25	75	100	4
8	BCA-NEP-607P	MOOCS/NPTEL	SEC	4	0	0	50	0	50	4
9	BCA-NEP-607	Research Project-II[@]	AUDIT	0	0	0	50	0	50	NC
		Grand Total		**20**	**0**	**18**	**350**	**350**	**700**	**29**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										
NOTE: @RESEARCH PROJECT – II is a Noncredit course (Audit Courses) and Student needs to qualify it but the marks will not be added in total marks.										

Format-1

Format -1

NEP-2020 IMPLEMENTATION 3 STEPS PLAN (FORMAT-1, 2 & 3)
CBCS: Statement of Credits distribution

College/School: SOCSA **Programme: BCA** **Duration: UG (6 Sem.), UG (Hons./Research) 8 Sem., PG (4 Sem.)**	**Credit range: Minimum 120 for UG** **160 for UG (Hons.), 80 for PG** **(Suggested by CBCS-NEP Committee)**

Course	Credit	Semester	Core Major	DSE Minor	AECC	SEC **	GE Interdisciplinary	General Elective	Value Added Course (VAC)	Industrial Training/ Survey / Research Project (4)	Total Credits
Certificate Course in Computer Applications		**Ist**	**C1-** 1). C Programming (Th 3+P 2) **C2-** 2).Mathematics for Computing-I (Th 4) **C3-** 3). Basics of Computers and Recent trends (Th. 3+P 2)	**DSE 1** **1).**ERP(Th4)/ **2).** M-Commerce (Th 4)	AECC 1 English Communication (Th. 3 Cr.) /Environment Science(Th. 5 Cr.)	Office Automati-on Tools (Th1 +P 2)		NCC	**VAC 1** Indian Ethos and Modern Management (Th2)		26 (Excluding NCC)

		2nd	**C4-** 1). Advance C Programming (Th3+P2) **C5-** 2). Mathematics for Computing-II (Th4) **C6-** 3). Digital Electronics and Computer System Architecture (Th. 3 P 2)	**DSE 2** 1). Digital Marketing (Th4)/ 2). Information System (Th4)/ 3). Cloud Computing (Th4)	**AECC-2** Environment and Ecology (Th 4 P 2)	SEC 2 – MOOCs/NPTEL IPR/E&I (Th. 2)	**GE-1**(Th. 2) A/B	NCC			29 (Excluding NCC)
Entry and Exit point											
Diploma in Computer Applications		**3rd**	1). Data Structure and Algorithms using C (Th3+P1) 2). Operating Systems (Th 4) 3). DBMS (Th3+P1)	1). Block Chain (Th4)/ 2). Data Mining and Data Warehousi-ng (Th4)	AECC 3- Human values& Professional Ethics (Th. 3 Cr.)	R-Programming (Th. 1 Cr. + P 1 Cr.))	GE 2 A/B (Th. 4 Cr.)	NCC	Cyber Security (Th. 3)		28 (Excluding NCC)
		4th	1). OOPs using Java (Th3+P1) 2). Software Engineering (Th4) 3). Computer Graphics (Th3+P1)	Computer Based Numerical and Statistical Techniques/ IOT (Th4)	AECC 4- Professional Skills. (Th. 3 Cr.)	E&I (Th. 2) Through NPTEL or IIMTU	GE-3 A/B (Th. 4 Cr.)	NCC			25 (Excluding NCC)
Note: Summer Internship in between 4th and 5th Sem. During session break (6-8 weeks) (Credit-4)											

Entry and Exit point											
Bachelor of Computer Applications		**5th**	1). AI (Th 3+P1) 2). Python Programming (Th3+P1) 3). Computer Networks (Th3+P1)	1). Big Data (Th4)/ 2). Data Science (Th4)				NCC	Health & Wellness (Th.2)	Summer Internship in between 4th and 5th Sem. During session break (6-8 weeks) (Credit-4) Field Visit/Industrial Project/ Final Year Research Project-I (Credit-2, for 3 years programmes)	24 (Excluding NCC)
		6th	1). Cryptography and Network Security (Th3+P1) 2). Web Development (Th3+P1) 3). Machine Learning Techniques (Th3+P1)	1). Natural Language Processing (Th 4)/ 2). Computer Vission (Th 4)		SEC 3- MOOCs/NPTEL (Th. 2 Cr.)		NCC		Field Visit/Industrial Project/ Final Year Research Project-II (Credit-4, for 3 years programmes)	22 (Excluding NCC)
Note: For 04 years undergraduate programmes, research projects will be of 6 credits each in last 02 semesters. *General Elective: Certificate will be provided to the students opted for NCC apart from degree. ** One SEC must be E&I and IPR (Can be through NPTEL or IPR can be from TIFAC, DST) **(To be introduced from 2027-2028)**											
M.C.A	**7 th**	C13- C14-	DSE 7-A/B +DSE-8	AECC 5-			NCC	VAC-1			23 (Excluding NCC)

	8 th	C15- C16-	DSE-9 A/B +DSE-10	AECC 6- Research &Publication Ethics	SEC 4- MOOCs (E&I/IPR)	GE -4 A/B	NCC	VAC-2	Seminar/Industrial Training/ Research (Credits-4)	26 (Excluding NCC)
	9 th	C17- C18-	DSE-11 A/B DSE-12			GE-4 A/B	NCC	VAC-3	Seminar/Industrial Training/ Research (Credits-4)	28 (Excluding NCC)
	10 th	C-19 C-20			SEC 5- MOOCs		NCC		Research Project (Credits -16)	20 (Excluding NCC)

Format-2

Format-2 BCA

IIMTU-NEP Implementation:

Program	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester	Prerequisite	Elective (For other faculty)
CERTIFICATE COURSE	FIRST YEAR (55 Cr.)	SEMESTER -I (26Cr.)	i) C1	3	3	40	'C' Programming	5		
			C1 (lab)	2	2	20	'C' Programming lab			
			C2	4	4	40	Mathematics for Computing-I			
			C3	3	3	40	Basics of Computers and Recent Trends	5		
			C3 (lab)	2	2	20	Basics of Computers and Recent Trends lab			
			ii) DSE1	4	4	40	ERP M-Commerce	5		
			iii) AECC 1	3	3	40	English Communication	5		
			iv) SEC1	1	1	10	Office Automation Tools	5		
				2	2	20	Office Automation Tools Lab	5		
			v) VAC 1	2	2	30	Indian Ethos and Modern Management	5		

		SEMESTER – II (29 Cr.)	i) C4	3	3	40	Advance C Programming	5		
			C4 (lab)	2	2	5	Advance C Programming lab			
			C5	4	4	20	Mathematics for Computing-II	5		
			C6							
			C6 (lab)	3	3	40	Digital Electronics and Computer System Architecture	5		
			ii) DSE 2	2	2	40	Digital Electronics and Computer System Architecture Lab	5		
				4	4	20	Digital Marketing Information System	5		
			iii) AECC 2	4	4	40	Cloud Computing	5		
				2	2	40	Environment & Ecology			
			iv) SEC 2	2	2	20	Environment & Ecology (Lab)			
						30	IPR/E&I			

Note:- Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.

Programme Outcome:	**Programme Specific Outcome:**
PO_1 PO_2 PO_3 ***Program Outcome and Program Specific Outcome – See Annexure – 1** **@List is attached in Annexure – 2**	PSO_1 PSO_2 PSO_3 PSO_4

Programme	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester)	Prerequisite	Elective (For other faculty)
DIPLOMA COURSE	SECOND YEAR (50 Cr.)	SEMESTER –III (23 Cr.)	ii) C7	3	4	45	Data Structure and Algorithm using C	5		
			C7 (lab)	1	4	10	Data Structure and Algorithm using C lab			
			C8	4	4	40	Operating System	5		
			C9	3	4	40	DBMS			
			C9 (lab)	1	4	10	DBMS Lab	5		
			ii) DSE 3	4	4	40	Block Chain	5		
							Data Mining and Data Warehousing	5		
			iii) AECC 3	3	4	40	Human Values and Professional Ethics	5		
			iv) SEC 3	1	4	40	R-Programming			
							R-Programming lab	5		
			v) VAC 2	3	4	40	Cyber Security			
Note:- Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.										
			i) C10	3	4	45	OOPs using Java	5		
			C10 (lab)	1	4	10	OOPs using Java Lab	5		
			C11	4	4	40	Software Engineering	5		
			C12	3	4	40	Computer Graphics	5		
			C12 (lab)	1	4	10	Computer Graphics Lab			
			ii) DSE 4	4	4	40	Computer based Numerical and Statistical Techniques	5		
							IOT			
			iii) AECC 4	3	4	40	Professional Skills	5		
			iv) SEC 4	2	4	40	E&I			
				4	-	-	Summer internship in between 4th and 5th sem.			
Note:- Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.										

Programme Outcome:	**Programme Specific Outcome:**
PO_1 PO_2 PO_3 ***Program Outcome and Program Specific Outcome – See Annexure – 1** **@List is attached in Annexure – 2**	PSO_1 PSO_2 PSO_3 PSO_4

Programme	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester)	Prerequisite	Elective (For other faculty)
DEGREE COURSE	THIRD YEAR (42 Cr.)	SEMESTER –V (18 Cr.)	i) C13	3	4	45	Artificial Intelligence	5		
			C13 (lab)	1	4	10	Artificial Intelligence Lab			
			C14	3	4	40	Python Programming	5		
			C14 (lab)	1	4	10	Python Programming Lab			
			C15	3	4	40	Computer Networks	5		
			C15 (lab)	1	4	40	Computer Networks Lab			
			ii) DSE 5 {	4	4	40	Big Data Data Science	5		
			iii) VAC 3	2	4	40	Health and Wellness	5		
				4			Industrial Training/Survey/Research Project			
		SEMESTER – VI (16 Cr.)	i) C16	3	4	45	Web Development	5		
			C16 (lab)	1	4	10	Web Development Lab			
			C17	3	4	40	Cryptography and Network Security	5		
			C17 (lab)	1	4	10	Cryptography and Network Security Lab			
			C18	3	4	40	Machine Learning Techniques	5		
			C18 (lab) {	1	4	10	Machine Learning Techniques Lab			
			ii) DSE 6 {	4	4	40	Natural Language Processing Computer Vision	5		
				4			Industrial Training/Survey/Research Project			

Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.

Annexure -1 **Programme Outcome:** PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems. PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.	**Programme Specific Outcome:** PSO1: The graduates are proficient in fundamental principles and methods of Computer Science, Mathematical and Scientific reasoning and are able to: PSO1: Apply fundamental concepts of integration, differentiation, vector calculus, probability & statistics, and discrete mathematics. PSO1: Design, create & evaluate algorithms appropriate to specific problems. PSO2: The graduates have understanding for: PSO1: Demonstrate capability for computers, computer network and server environments and there troubleshooting. PSO1: Capacity to handle cloud computing environment and solutions. PSO1: Well defined knowledge for solving problems of security and threats in information knowledge domain.

Format-3

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mathematics for Computing-I**
Course Code: 24BCA-102	**Title: Mathematics for Computing-I**

Course Objectives:

CO1: Compute the rank and inverse of a matrix and solve system of linear equations.
CO2: Computation of Limits of Various Types of Functions, Continuity over an Interval, to find Intermediate Value Theorem and type of Discontinuities.
CO3: Understand the Derivatives, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation, Successive Differentiation.
CO4: Use of different theorems like Rolle's Theorem, Mean Value Theorem, Leibnitz Theorem, Partial Differentiation, Euler's Theorem.
CO5: Understanding of Integral as Limit of Sum, Riemann Sum, Fundamental Theorem of Calculus, Indefinite Integrals.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Determinants:** Definition, Minors, Cofactors, Properties of Determinants, **Matrices**: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramer's Rule, Rank of Matrix, Eigen Vectors of a Matrix, Cayley-Hamilton Theorem (without proof)	8
II	**Limits & Continuity**: Limit at a Point, Properties of Limit, Computation of Limits of Various Types of Functions, Continuity at a Point, Continuity Over an Interval, Intermediate Value Theorem, Type of Discontinuities.	8
III	**Differentiation:** Derivative, Derivatives of Sum, Differences, Product & quotients, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation, Successive Differentiation.	8
IV	**Application of Differentiation:** Rolle's Theorem, Mean Value Theorem, Expansion of Functions (Maclaurin's & Taylor's), Indeterminate Forms, L' Hospitals Rule, Maxima & Minima, Leibnitz Theorem, Partial Differentiation, Euler's Theorem.	8
V	**Integration:** Integral as Limit of Sum, Riemann Sum, Fundamental Theorem of Calculus, Indefinite Integrals, Methods of Integration	8

	Substitution, By Parts, Partial Fractions, Integration of Algebraic and Transcendental Functions, Definite Integral.	

Text Books:

1. Babu Ram, "*Engineering Mathematics*", Pearson Education
2. H.K. Dass, "*Advanced Engineering Mathematics*", S. Chand & Company

Reference

1. Erwin Kreyszig, "*Advanced Engineering Mathematics*", John Wiley & Sons.
2. B. S. Grewal, "*Elementary Engineering Mathematics*", Khanna Publishers.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report	10
Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to find the rank and inverse of matrix.
CO2: Understand the various types of Functions and the concept of continuity.
CO3: Able to understand the Chain Rule and find the Derivatives of Composite Functions and Logarithmic functions.
CO4: Able to use the different theorems of differentiation.
CO5: Able to solve the calculus problems.

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Basics of Computers and Recent Trends**
Course Code: 24BCA-103	**Title: Basics of Computers and Recent Trends**

Course Objectives:
CO1: To develop a foundational understanding of computer systems.
CO2: To provide students with a foundational understanding of the Internet, its components.
CO3: To introduce students to the fundamental concepts, and classifications of operating systems.
CO4: To provide students with a basic understanding of data communication principles.
CO5: To familiarize students with emerging technologies such as cloud computing, mobile computing, virtual and augmented reality, and the Internet of Things.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L:3
T:0
P:0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Basics of Computer:** Introduction to computer system, uses, types. Overview of Data Representation - Number systems and Coding Schemes (ASCII and UNICODE). Overview of Human Computer Interface - Relationship between Hardware and Software, Types of software, utility programs. Role of Computers in Business, Manufacturing, Media, Defense Services and Education.	8
II	**Overview of Internet and Its Uses:** Introduction to Internet. Role and importance of Internet, Overview of Web Server and Web clients like web browser or web applications, world wide web, Search Engines, E-mail, e-Library, e-business.	8
III	**Overview of Operating system:** Definition, Functions, Types, Classification, Elements of command based and CUI and GUI based operating system (DOS and WINDOWS).	8
IV	**Overview of Computer Network:** Introduction to Data communication, Modes of Communication (Simplex, Half-Duplex and Full- Duplex) Introduction to Computer Networks, Types of Computer networks (LAN, WAN and MAN), Network Topologies.	8
V	**Recent Trends Technologies:** Cloud Computing - Meaning, Features, & Service models (IaaS, PaaS, SaaS), Advantages and Disadvantages, Mobile Computing - Meaning, Business Applications of Mobile computing, Virtual reality & Augmented Reality - Meaning and applications, Internet of Things (IoT) – Definition, Sensors, Applications of IoT, Industrial IoT.	8

Text Books:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
2. Norton P., "Introduction to Computers", McGraw Hill Education.
3. Introduction to Information Technology by ITL Education Solutions Limited, second edition.

Reference

1. Balagurusamy E., "Fundamentals of Computers," McGraw Hill
2. Thareja R., "Fundamentals of Computers," Oxford University Press.
3. Information Technology The breaking wave by Dennis Curtin Tata McGraw-Hill edition
4. Introduction to Information Technology by P. Aksoy and L. DeNardis, Cengage Learning, 2006

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Students will be able to identify and explain the different types of computer systems.
CO2: Students will be able to describe key elements of Internet infrastructure
CO3: Students will be able to compare CUI and GUI operating systems.
CO4: Students will be able to describe various modes of communication and types of computer networks.
CO5: Analyze the characteristics and applications of cloud service models, mobile computing.

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: ERP**
Course Code: 24BCA-104-1	**Title: ERP**

Course Objectives:

CO1: Understand what an enterprise is, how it can be managed with ERP?
CO2: To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
CO3: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 Theory 1 Hr = 1 credit

Units	Contents	No. of Lectures Allotted
I	What are Enterprise, Enterprise Resource Planning, Evolution and Structure of ERP, Basic ERP Concepts, Benefits and Risks of ERP**?**	**8**
II	ERP Implementation: Objectives, Introduction, ERP Implementation Methodology, Evaluation Of The Various ERP Packages.	**8**
III	ERP Business: Selection Criteria For ERP Packages, Implementation of ERP Packages	**8**
IV	ERP Market Place: Objectives, Introduction, Reasons for the Growth of The ERP Market.	**8**
V	**ERP & E-COMMERCE:** Understanding E-Commerce, Distinct Categories Of E-Commerce, Categories Of E-Commerce, and Relevance Of ERP With E-Commerce.	**8**

Text Books

1. Alexis Leon, "ERP Demystified", Tata McGraw–Hill Education.
2. Vinod Kumar Garg, N K Venkitakrishnan, "*Enterprise Resource Planning–Concepts and Practice",* PHI.

Referential Books

1. Joseph A. Brady, Ellen F. Monk, Bret J. Wagner, "Concepts in Enterprise Resource Planning", Course Technology Cengage Learning.

2. Rahul V. Altekar, *"Enterprise wide Resource Planning"*, Tata McGraw Hill.	
Evaluation / Assessment Methodology	
	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total	**100**
Prerequisites for the course: NIL	

Course Learning Outcomes:

CO1: Able to Understand what an enterprise is, how it can be managed with ERP?

CO2: Able to provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.

CO3: Able to focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.

CO4: Able to train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.

CO5: Able to aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: M-Commerce**
Course Code: 24BCA-104-2	**Title: M-Commerce**

Course Objectives:

CO1: Understand what M-Commerce is, how it can be managed, relation with E-Commerce?
CO2: To provide a contemporary and forward-looking on theory and practice of M- Commerce.
CO3: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: To train the students to develop the basic understanding of how M- Commerce, enriches the business organizations in achieving a multidimensional growth.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Units	Contents	No. of Lectures Allotted
I	**Introduction to Mobile commerce:** Definition, Scope of Mobile Commerce, Benefits and Limitations of M-Commerce, M-Commerce Framework, M-Commerce business Models, E-Commerce Vs M-Commerce, Impact of M-Commerce.	8
II	**Mobile commerce technology :** Types of Mobile Clients (Mobile Phones, PDAs, Laptop Computers, Vehicle-mounted Devices, Hybrid Devices etc.). Device Limitations: Considerations for user Interface and Application Design, Device Location Technology: GPS, Triangulation. Mobile Client Software: Mobile Device Operating Systems, Micro browsers, Mobile Device Communications Protocols: WAP, I-Mode, Mobile Device Page Description Languages, Mobile Device Application Software.	8
III	**Wireless communications of technology** Wireless Wide Area Network (WWAN) Technology: Cellular Systems, 2G (CDMA, TDMA, GSM), 2.5G (GPRS, EDGE), 3G (WCDMA/UMTS, CDMA2000), 4G, 5G. Wireless Local, Area Network (WLAN) Technology (Wi-Fi), Wireless Metropolitan Area Network (WMAN) Technology (WiMAX), Wireless Personal Area Network (WPAN) Technology	8

	(Bluetooth).	
IV	**M-Commerce applications:** Mobile Financial Services, Mobile Advertising, Mobile Payment, Mobile Ticketing, Mobile Product Location and Shopping, Mobile Business Services, Mobile Auction, Mobile Entertainment, Mobile Office, Mobile Distance Education.	**8**
V	**BUSINESS-TO-BUSINESS MOBILE E-COMMERCE** Enterprise Enablement, Email and Messaging, Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare), Field Sales Support (Content Access, Inventory), Asset Tracking And Maintenance/Management, Remote IT Support, Customer Retention (B2C Services, Financial, Special Deals), Warehouse. **Future of M- Commerce:** Future challenges, security, scalability.	**8**

Text Books

1. Advanced E-Commerce and Mobile Commerce, Divakara Reddy N., Suman M., Himalaya Publication house Pvt. Ltd., ISBN 978-93-5202-139-0, New Delhi.
2. MOBILE COMMERCE, Bandyopadhyay, Karabi, PHI Learning Pvt. Ltd., Delhi, Edition II, ISBN: 9789391818425.

Referential Books

1. Brian E. Mennecke, Troy J. Strader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.
2. P. J. Louis, "M – Commerce Crash Course", McGraw – Hill Companies February 2001.
3. Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" Cambridge University Press March 200l.

Evaluation / Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to Understand what M-Commerce is, how it can be managed, relation with E-Commerce?

CO2: Able to provide a contemporary and forward-looking on theory and practice of M-Commerce.

CO3: Able to focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.

CO4: Able to train the students to develop the basic understanding of how M- Commerce, enriches the business organizations in achieving a multidimensional growth.

CO5: Able to at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Feature Engineering**
Course Code: 25BCA-104-3	**Title: Feature Engineering**
Course Objectives:	
CO1: Extract useful features from data and convert them to features. CO2: Learn how to deal with infrequent, rare, and unseen categories. CO3: Learn to transform categorical variables into no. while capturing meaningful information. CO4: Learn to convert numerical variables into discrete ones. CO5: Learn techniques to pre-process data and build more powerful machine learning models.	
Nature of Paper: DSE	
Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)	
L:4 T:0 P:0(In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4 Hrs./Week= 4 Credits)	

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Feature Engineering, Importance of feature engineering, Evaluation of machine learning algorithm and Feature engineering procedures. Feature Understanding: Feature Improvement-cleaning datasets, Feature Selection-removing bad attributes, Feature construction, Feature Transformation, Feature learning	8
II	**Data Pre-processing and Missing Values:** Handling missing values, identification, imputation techniques (mean, median, regression-based), and impact on models. Basics of Feature Representation: Scalars and Vectors, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling).	8
III	**Encoding and Transformation Techniques Handling categorical variables:** one-hot encoding, label encoding, and target encoding, Handling text data: bag-of-words representation, TF-IDF encoding, and word embeddings. Numerical transformations: handling skewed distributions, logarithmic transformations, and scaling techniques. Binning and discretization of continuous variables.	8
IV	**Feature Selection:** Importance of Feature Selection in Machine Learning, Goals of Feature Selection, Classes of Feature Selection Methodologies. Effect of Irrelevant Feature, Univariate feature selection: statistical tests and feature importance, Recursive Feature Elimination, Stepwise Selection.	8
V	**Feature Transformations:** Intuition, Derivation, Linear Projection, Variance and Empirical Variance - Vector Formulation, General Solution of the Principal	8

	Components, Transforming Features, Implementing PCA, PCA in Action, Considerations and Limitations of PCA, Use Cases	

Text Books:

1. Max Kuhn , Kjell Johnson, "Feature Engineering and Selection: A Practical Approach for Predictive Models" 1st Edition, Chapman & Hall/CRC Data Science Series, ISBN 13- 978- 1-138-07922-9.
2. Sinan Ozdemir, Divya Susarla, "Feature Engineering Made Easy", Packt Publishing, ISBN 978-1-78728-760-0

Reference

1. Alice Zheng & Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for data scientist", Oreilly Publications

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Create new features from existing ones.
CO2: Impute missing data and encode categorical variables.
CO3: Transform numerical variables and change their distribution.
CO4: Perform discretization, remove outliers, and extract features from date & time.
CO5: Reduce dimensionality of data using PCA.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA**	**Year** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Basics of Data Analytics using Spread Sheet**
Course Code: 24BCA-104-4	**Title: Basics of Data Analytics using Spread Sheet**

Course Objectives:

CO1: To familiarize students with the fundamental concepts of data analytics, types of data, applications, and basic use of spreadsheet tools for data handling and analysis.

CO2: To enable students to acquire foundational skills in Microsoft Excel for entering, organizing, and managing worksheet data, performing basic operations, and applying simple formulas and functions effectively.

CO3: To equip students with the skills to create and use formulas, apply various functions, generate and format charts, and perform basic data analysis using spreadsheet tools.

CO4: To develop students' ability to visualize and analyze data by creating and customizing charts, and applying essential spreadsheet data analysis tools.

CO5: To enhance students' proficiency in advanced Excel functions for conditional analysis, data visualization, and automation using macros.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week= 4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Data Analytics:** Understanding data and its types (Structured, Unstructured, semi structured), What is Data Analytics, Type of Data Analytics, Application of data Analytics, Introduction to spread sheet tools (Excel, Google sheets)	8
II	**Introduction to Excel Basics:** Entering and editing worksheet data, Performing basic worksheet operations, Use of simple arithmetic operations, Working with excel ranges and tables, Working with Formulas and Functions, Selecting Columns & Rows, Changing Column Width & Row Height, Auto fitting Columns & Rows, Hiding/Un hiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell.	8
III	**Creating Formulas:** Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum, Using text functions to manipulate text, Using date and time functions, Using formulas for financial analysis.	8
IV	**Spreadsheet Charts:** Creating Charts, Different types of chart, Formatting	8

	Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table **Data Analysis** Sorting, Filter, Text to Column, Data Validation	
V	**Advanced Excel Functions for Data Analysis:** Using formulas for Conditional Analysis, Use the IF function to evaluate a condition and return values based on the result, Apply the AND and OR functions to evaluate multiple conditions, Perform conditional calculations(SUMIF, COUNTIF, AVERAGEIF), Data Visualization with Excel Demonstration of creation of a bar chart representing sales data for different months. Customize the appearance of a chart, including colors, fonts, titles, legends and axis labels, Making Macros Recording Macros, Running Macros, Deleting Macros	8

Text Books:

1. Excel 2019 bible, Alexander, M., Kusleika, R., & Walkenbach, J. (2018), John Wiley & Sons.
2. Excel data analysis for dummies, Nelson, S. L., & Nelson, E. C. (2014), John Wiley & Sons.
3. Data Analysis with Microsoft Excel , Berk, K. N., & Carey, P. (1998), Pacific Grove, CA: Duxbury Press.

Reference

1. Excel Data Analysis Modeling and Simulation., Hector, G. (2019), Spinger.
2. Microsoft Excel data analysis and business modelling, Winston, W. (2016), Microsoft press.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course:

Course Learning Outcomes:

CO1: By the end of the course, students will be able to identify different types of data, explain data analytics concepts, recognize its applications, and perform basic data operations

CO2: Students will be able to create and edit worksheets, manage rows, columns, and ranges, apply basic arithmetic and functions, and format spreadsheet data for efficient presentation and analysis.

CO3: students will be able to apply formulas and functions for calculations and text manipulation, create and customize charts, and use spreadsheet features like sorting, filtering, and data validation for effective data analysis

CO4: By the end of the course, students will be able to design and format various chart types, modify chart elements, and perform data analysis using sorting, filtering, text-to-column, and data validation features.

CO5: By the end of the course, students will be able to perform conditional calculations using advanced functions, create and customize charts for data presentation, and automate repetitive tasks through recording and managing macros.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 2 **Theory: 2** **Practical: 0**	**Course: Office Automation Tools**
Course Code: 24BCA-105	**Title: Office Automation Tools**

Course Objectives:
CO1: To understand the basic knowledge of computer about its generationsand windows.
CO2: To apply the changing background of windows desktop, creating shortcut how to display toolbar.
CO3: To understand student will get the basic knowledge to create a file in MS word and format the files.
CO4: To understand The student will knowledge enter data in Excel, arrange data format data, how to use various functions sort information.
CO5: To understand create different types of Charts and Tables.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 40% Marks / 2 Credits (Internal + ESE)

L: 2
T: 0
P: 0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to File Formats with Types and Extension:** Text file, PDF file, JPG file, GIF file, ZIP file. **Introduction to Windows: Introduction** to Windows, Start Menu, Working with Programs, Customizing with Windows, Accessories of Windows, Introduction of software, Types of software.	4
II	**Introduction to Ms-WordWorking with Documents:** Opening & Saving files, editing text documents, Inserting, Deleting, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Formatting page & setting Margins. **Formatting Documents:** Setting Font styles, Font selection-style, size, color etc, Type face - Bold, Italic, Underline. **Setting Page style:** Formatting Page, Page tab, Margins, Layout settings, Border& Shading, Columns, Header & footer, Setting Footnotes. **Tools –** Spell Checks, Mail merge, Templates. **Creating Tables**: Table settings, Cell, Insert to cell, Borders, Alignments, Insertion, deletion, Merging, Chart in MS word, Table in MS word.	4
III	**Introduction to Microsoft Excel:** Spread Sheet & its Applications, Opening Spreadsheet, Menus - main menu, Formula Editing, Formatting, Toolbars, Using Icons, Shortcuts.	4

	Working with Spreadsheets: opening, saving files, setting Margins, Converting files to different formats (importing, exporting, sending files to others) **Entering & Deleting Data:** Entering data, Cut, Copy, Paste, Undo, Redo, Highlighting values, Find Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols. **Formulas and Functions in Microsoft Excel:** Introduction, calculating with the help of Formulas and Functions (SUM, AVERAGE, COUNT, MAX, MIN, IF), Row, Columns and Cells, Table Format, Sorting.	
IV	**Basic of Microsoft Power Point:** Introduction to presentation – Opening new presentation, Different presentation templates, Setting backgrounds, Selecting presentation layouts. **Creating a presentation:** Setting Presentation style, Adding text to the Presentation. **Formatting a Presentation:** Adding style, Color, Arranging objects, Adding Header & Footer, Slide Background, Slide layout..	4
V	**Microsoft Access:** Introduction of M.S Access, planning a database, Starting Access, Create a new database.	4

Text Books:

1. E. Balagurusawy, V. Rajaraman "*Office Automation Tool"*.McGraw-Hill.
2. Kevin Pitch*"MS-Office Windows*". Dinesh Maidasani MS Office.

Reference

1. Priti Sinha ,Pradeep K. Sinha" *Office Automation Tool*".6th Edition

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand will get the basic knowledge of computer about its generations and types Windows.

CO2: Able to understand Changing background of windows desktop, creating shortcut how to display toolbar.

CO3: Able to understand Student will get the basic knowledge create a file in word and format the files.

CO4: Able to understand the student will the basic knowledge enter data in excel, arrange data format data, how to use various functions sort information.

CO5: Able to understand create different types of chart and Tables.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Office Automation Tools Lab**
Course Code: 24BCA-105P	**Title: Office Automation Tools Lab**

Course Objectives:
CO1: To understand Office tools course would enable the students in crafting professional word documents, excel spread sheets, power point presentations using the Microsoft suite of office tools.
CO2: To understand Familiarize the students in preparation of documents and presentations with office automation tools.
CO3: To understand Student will get the basic knowledge to create a file in MS word and format the files.
CO4: To understand Create different types of Charts and Tables.
CO5: To understand Changing background of windows desktop, creating shortcut how to display toolbar.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Understanding the desktop, taskbar, and start menu. Navigating files and folders, understanding different views, and managing files. How to create, rename, and organize folders. How to install new programs and remove unwanted ones.	1
2.	Create a Resume and other document using the table and shapes, Font color, Font size Text highlight color, Page number, Margins, Watermark, Page border, Page color, Align text.	1
3.	Create a flowchart using, a. Proper shapes like ellipse, arrows, rectangle, and parallelogram. b. Use grouping to group all the parts of the flowchart into one single object.	1
4.	Create a table using table menu with, a. At least 5 columns and 10 rows. b. Merge the first row into one cell. c. Merge the second row into one cell, then split the second row into three cells. d. Use proper table border and color	1
5.	Create a table using two columns, a. The left column contains all the short-cut keys and right side column contains the function of the short-cut keys. b. Insert a left column using layout option. Name the heading as Serial No.	1
6.	Opening Microsoft Excel Cells Filling in cells Selecting, Copying, Cutting, and Pasting Pasting Formulas	2

	Inserting or deleting row or columns Changing Column Width Formatting cells Changing fonts Saving an excel file	
7.	Create a table "Student result" with following conditions. a. The heading must contain, Sl. No., Name, Mark1, Mark2, Mark3, Total, average and result with manual entry. b. Use formulas for total and average. c. Find the name of the students who has secured the highest and lowest marks. D. Round the average to the nearest highest integer and lowest integer (use ceiling and floor function respectively).	2
8.	Create a Student Table in MS-Access with the following features: a. Roll Number b. Student Name c. Class d. Marks in Subject 1, Subject 2, Subject 3 e. Total f. Average g. Result	2
9.	Create a Personal Information table in MS-Access with the following fields: a. First Name b. Middle Name c. Last Name d. Nationality e. Gender f. Temporary Address g. Permanent Address. Generate a Form and Report.\	2
10.	Create a minimum of 10 slides with a slide theme appropriate for the topic.	2

Reference / Text Books:

- Office Automation Tools Lab/MS. Word:" by M .L. Humphrey".
- Office Automation Tools Lab/MS power point/MS. Access:" by MOIRA Stephen,.Kevin Pitch.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report / Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

CO1: Students will be able to develop to create the folder, files based on office automation tools.
CO2: Students will be able to understand create the resume and all function used in MS word.
CO3: Students will be able to understand create the Mark sheet and all function used in MS excel.
CO4: Students will be able to understand Create a Student Table in MS-Access with the following features.
CO5: Students will be able to understand Create a minimum of 10 slides with a slide theme appropriate for the topic.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Basics of Computers and Recent Trends Lab**
Course Code: 24BCA-107P	**Title: Basics of Computers and Recent Trends Lab**

Course Objectives:
CO1: To introduce the fundamental components of computer hardware, including input, output, processing, and memory devices, and their roles in a computer system.
CO2: To develop practical skills in using operating systems, including file management, executing DOS commands, and managing installed applications.
CO3: To enable students to create and manage online accounts, such as email and e-commerce portals, for communication and digital transactions.
CO4: To explore the hardware elements used in computer networking.
CO5: To examine real-world applications of cloud computing technologies**.**

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Practical Allotted
1.	Demonstrate the Computer Hardware Components- Input devices (KB, Mouse, Scanner), Output Devices (Monitor, Printers, Speaker), Process Devices (Motherboard, Microprocessor) and Memory Devices (RAM, ROM, HDD, DVD)	1
2.	Create an E-mail Id account in various mail portal like Gmail, yahoo etc.	1
3.	Create an account in various E-business portal like Amazon, Flipkart etc.	1
4.	Search the e-library portal through search engine and create an account to access the various services of library.	1
5.	Practices the various DOS internal and external commands.	2
6.	Explore the entire desktop Explore the file manager. Create, rename, and organize files and folders. To install and uninstall programs.	2
7.	Demonstrate the Computer Network Hardware Components- Various types of network cables (Coaxial, Twisted pair), HUB, Switches (16 and 32 Port), Connectors (T-connector, USB connector)	2
8.	Explore the use of cloud computing in various cloud based applications like Data Storage, AWS, Social Media etc.	2

Reference / Text Books:

1. Balagurusamy E., " Fundamentals of Computers", McGraw Hill
2. Thareja R., "Fundamentals of Computers", Oxford University Press.
3. Andrew ,S. Tanenbaum, Fifth Edition
4. An Essential Guide to windows 10.
5. DOS – The Complete Reference, Tata-McGraw Hill, 1997 Edition-4th.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	-
2) Presentations /Seminar	25
3) Assignments	-
4) Practical File, Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

CO1: Identify and describe the purpose and functions of various computer hardware components, including input, output, processing, and storage devices. *(Bloom: Understanding)*

CO2: Demonstrate the ability to perform basic operating system functions, such as navigating the desktop, managing files and folders, and using internal and external DOS commands. *(Bloom: Applying)*

CO3: Create and manage user accounts on email services (e.g., Gmail, Yahoo) and e-commerce platforms (e.g., Amazon, Flipkart), showing competence in digital identity management. *(Bloom: Applying)*

CO4: Explain the function and setup of common network hardware, including different types of cables, switches, and connectors, used in networking environments. *(Bloom: Understanding)*

CO5: Analyze how cloud computing is applied in services like online data storage, AWS infrastructure, and social media platforms, and describe its benefits and limitations. *(Bloom: Analyzing)*

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Problem solving techniques using 'C' Language**
Course Code: 25BCA-101	**Title: Problem solving techniques using 'C' Language**

Course Objectives:
CO1: Explain the needs of programming language.
CO2: Learn Conditional and Iterative Control Statements in 'C' language.
CO3: Students will be able to learn the basics of functions and array in 'C' language.
CO4: Students will be familiar with uses of string and their function.
CO5: Students will be familiar with File handling programs to perform read write operations and how to use functions in 'C' language.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L:3
T:0
P:0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to 'C' Language:** History, C Character Set, Tokens, Keywords, Constants, Identifiers, Variables, Data Types, Comments, Structures of 'C' Program. Operators **Storage Classes:** Automatic, External, Static & Register.	8
II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, go to Statement, Loops (for, while, do-while) in C, Nested Loops, break and continue Statements. **Macro:** Definition of Macro, Uses of Macro, Difference between macro and function, Difference between Macro and Pre-processor	8
III	**Functions:** Advantages of Functions, declaring a Function, defining a Function, calling a Function, Argument Passing – Call by Value, Call by Reference, Types of Functions, Recursion. **Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data from Array, Multi-Dimensional Arrays.	8
IV	**String:** 'C' String Declaration Syntax, 'C' String Initialization, String Function- strlen (string_name), strcpy (s1, s2), strcmp(str1, str2), strcat(s1, s2).	8
V	**File Handling:** Introduction, File Types- Text, Binary, The File Pointer, Opening a File, Closing a File, Reading and Writing a File, File Handling Functions: fgetc(), fputc(), fputs(), fgets(), fprintf(), fscanf(), fwrite(), fread(), fseek().	8

Text Books:

1. Stephen W. Sagman & Gail Taylor, "*MS-Office 2000For Windows*", Peachpit Press.
2. Balaguruswamy, "*Programming in ANSI C",* Tata Mc. Graw-Hill education.
3. YashwantKanetkar, *"Let us C",* BPB Publications

Reference

1. V. Rajaraman, "*Fundamental of Computers*", Prentice-Hall of India.
2. V Rajaraman, "*Computer Basics and C Programming*", PHI Learning
3. Ashok N. Kamthane, "*Programming in C*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand basic concepts of 'C' programming language.
CO2: Familiarize students with Conditional and Iterative Control Statement in 'C' language.
CO3: Students will be able to use functions and array in 'C' language.
CO4: Students will be able to solve problems with string functions.
CO5: Familiarize students with File Handling in 'C' language.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Problem solving techniques using 'C' Language Lab**
Course Code: 25BCA-106P	**Title: Problem solving techniques using 'C' Language Lab**

Course Objectives:
CO1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.
CO2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements.
CO3: Students will be familiar with the concept of Arrays.
CO4: Students will be able to develop a Program with Functions Operations.
CO5: Students will be familiar with File handling programs to perform read-write operations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Write a program to display “hello world” in C.	1
2.	Write a program to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd.	1
3.	Write a program to check whether the entered year is a leap year or not (a year is a leap if it is divisible by 4 and divisible by 100 or 400.)	1
4.	Write a program to read a string and check for palindrome without using string-related functions (a string is a palindrome if its half is mirror by itself.	1
5.	Write a program to find the biggest among three numbers.	1
6.	Write a program to print a table of a given number.	1
7.	Write a program to print a factorial of a given number.	1
8.	Program to read two integer and two floating point numbers.	1
9.	Program to accept the marks of 5 subjects and finds the sum and percentage marks obtained by the student.	1
10.	Program to calculate the simple interest and compound interest (The Principal, Amount, Rate of Interest and Time are entered through keyboard).	1

11.	Program to calculate the area and circumference of a circle.	1
12.	Program that swaps values of two variables using a third variable.	1
13.	Program that swaps the values of two variables without using a 3rd variable.	1
14.	Program to calculate and print the area of triangle, where the three sides of the triangle is given as input.	1
15.	Program that checks whether the two numbers entered by the user are equal or not.	1
16.	Program to find whether a given number is even or odd.	1
17.	Write a Program to read two numbers and an operator (+, -, *, /) which performs the specified operation and display the result.	1
18.	Program to display the first N numbers.	1
19.	Program to print the sum of all numbers up to a given number.	1
20.	Program to print sum of even and odd numbers from 1 to N numbers.	1
21.	**Program** to demonstrate the use of **macros** using the #define preprocessor directive.	1
22.	Program that simply takes elements of the array from the user and finds the sum of these elements.	1
23.	Program to find the minimum and maximum element of the array.	1
24.	Write a C program that asks the user for their name and greets them with a welcome message	1
25.	Write a program to copy the content of one file to another file.	1

Reference / Text Books:

- The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie.
- C Programming: A Modern Approach" by K. N. King.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

PO1: Students can develop programs based on fundamental concepts of programming in C.
PO2: Students can solve problems based on Conditional and Iterative Control Statements.
PO3: Students can learn Complete Programming Concepts of Arrays.
PO4: Students can learn conceptual programming with Functions.
PO5: Students can perform File handling programs with read and write concepts

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: CERTIFICATE **Class: BCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course:- Mathematics for computing II**
Course Code:24BCA-202	**Title: Mathematics for computing -II**

Course Objectives:

1. Basics of set theory and how to organize the data in meaningful manner.
2. Creating a relation between data and how to grouping of data with specific rules.
3. Partial order relation and basics of ordered theory with graphical representation with number system.
4. **3-D** Coordinate geometry their representation and basics of images and their representation.
5. Basics of differential equation and how to represent basic problems in the form of equations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit(4 Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
1	**Sets:** Sets, Subsets, Equal Sets, Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications.	**8**
2	**Relations and Functions:** Properties of Relations, Equivalence Relation, Partial Order Relation, Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.	**8**
3	**Partial Order Relations and Lattices:** Partial Order Sets, Representation of POSETS using Hasse diagram, Chains, Maximal and Minimal Point, Glb, lub, Lattices; Algebraic Systems, Principle of Duality, Basic Properties, Sub lattices, Distributed & Complemented Lattices.	**8**
4	**3D Coordinate Geometry:** Coordinates in Space, Direction Cosines, Angle Between Two Lines, Projection of Join of Two Points on a Plane, Equations of Plane, Straight Lines, Conditions for a line to lie on a plane, Conditions for Two Lines to be Coplanar, Shortest Distance Between Two Lines, Equations of Sphere, Tangent plane at a point on the sphere.	**8**
5	**Differential Equation:** First order and first degree differential equations, separation of variables, Homogeneous, linear, exact differential equations, second order linear equations with constant coefficients.	**8**

Text Books:-

1. C. L. Liu, "Elements of Discrete Mathematics", McGraw Hill Education.
2. H.K. Dass, "*Advanced Engineering Mathematics*", S. Chand & Company.
3. J.P Chauhan, " Mathematics", Krishna Publication.

Reference Books:-

1. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists", Reston Pub. Co.
2. Kenneth H. Rosen, "Discrete Mathematics and Its Applications: With Combinatorics and Graph Theory", Tata McGraw Hill Education

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:-

1. Understand the basics of set theory and how to organize the data in meaningful manner.
2. Analyze to create a relation between data and how to grouping of data with specific rules.
3. Apply Partial order Relation and basics of ordered theory with graphical representation with number system.
4. Application of 3-D Geometry their representation and basics of images and their representation.
5. Understand the basics of differential equation and how to represent basic problems in the form of equations.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: BCA **Class: BCA**	**Year: I** **Semester: II**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Digital Electronics and Computer System Architecture**
Course Code: 24BCA-203	**Title: Digital Electronics and Computer System Architecture**

Course Objectives:
CO1: Understand Fundamental Computer Organization Concepts.
CO2: Analyze Computer Arithmetic and Register Operations.
CO3: Explain CPU Organization and Control Unit Design.
CO4: Evaluate Memory and Input-Output Organization.
CO5: Understand Advanced Processing Concepts.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Basic Functional units of Computers:** Functional units, basic Operational concepts, Flip Flops, Types of Flip Flops Number Systems, Logic Gates and Combinational Circuits, Bus structures. Software, Performance, Multiprocessors, Multicomputer. Data Representation: Signed number representation, fixed and floating-point Representations. Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms. Error detection and correction codes.	8
II	**Register Transfer Language and Micro Operations:** RTL- Registers, Register transfers, Bus and memory transfers. Micro operations: Arithmetic, Logic, and Shift micro-operations, Arithmetic logic shift unit. Basic Computer Organization and Design: Computer Registers, Computer instructions, Instruction cycle. Instruction codes, Timing and Control, Types of Instructions: Memory Reference Instructions, Input – Output and Interrupt.	8
III	**Central Processing Unit organization:** General Register Organization, Stack organization, Instruction formats, addressing modes, Data Transfer and Manipulation, Program Control, CISC and RISC processors Control unit design: Design approaches, Control memory, Address sequencing, micro program example, design of CU. Micro Programmed Control.	8
IV	**Memory Organization:** Semiconductor Memory Technologies, Memory hierarchy, Interleaving, Main Memory-RAM and ROM chips, Address	8

	map, Associative memory-Hardware organization. Match logic. Cache memory-size vs. block size, Mapping Functions-Associate, Direct, Set Associative mapping. Replacement algorithms, write policies. Auxiliary memory Magnetic tapes etc.	
V	**Input–Output Organization:** Peripheral devices, Input-output subsystems, I/O device interface, I/O Processor, I/O transfers–Program controlled, Interrupt driven, and DMA, interrupts, and exceptions. I/O device interfaces – SCII, USB Pipelining and Vector Processing: Basic concepts, Instruction level Parallelism Throughput and Speedup, Pipeline hazards.	8

Text Books:

1. Morris Manno, "Computer System Architecture", Pearson Education.
2. W. Stallings, "Computer Organisation and Architecture", Pearson Education.

Reference:

1. "Computer Architecture and Organization", 3rd Edition by John P. ayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by i. William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry ii. F. Jordan, Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain the basic functional units of a computer, number systems, logic gates, combinational circuits, bus structures, and data representation methods.

CO2: Perform arithmetic operations using various algorithms and demonstrate register transfer language (RTL) and micro-operations in digital systems.

CO3: Describe CPU organization, instruction formats, addressing modes, instruction cycle, and design principles of hardwired and micro programmed control units.

CO4: Analyze memory hierarchy, cache mapping techniques, replacement policies, and different input-output transfer mechanisms including DMA and interrupt-driven I/O.

CO5: Evaluate performance improvement techniques such as pipelining, instruction-level parallelism, multiprocessors, multicomputer, and vector processing systems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme : Certificate **Class : BCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course : Digital Marketing**
Course Code- 24BCA-204(1)	**Title: Digital Marketing**

Course Objectives

CO1. Understand the marketing in the digital era.
CO2. Understand the business drivers in the virtual world; such as social media, online branding, traffic building on web-site, ecommerce.
CO3. Understand the online tools for marketing.
CO4. To understand the contemporary digital revolution.
CO5. To Apply critical thinking and problem-solving skills to real-world digital marketing scenarios.

Nature of Paper:

Minimum Passing Marks / Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0
Theory 1Hr = 1 credit

Units	Contents	No. of Lectures Allotted
I	**Digital world**: Marketing in the Digital Era, E-marketing. Building Website using Website/ Blog Foundations of analytics- Search engine optimization, Key Words, Key Word planner tools, SEO- One page and Off page Techniques: Indexing and Key word placing and content optimization.	**8**
II	**Business Drivers in the Virtual World:** Social media, Online Branding, Traffic Building, Web Business Models, E-commerce, E-marketing, Online Marketing, Online Consumer, Customer Relationship Management, Online Tools for Marketing	**8**
III	Contemporary Digital Revolution 5, Online Communities and Co-creation, The World of Facebook, Future of Marketing in gaming and Apps Engagement Marketing through Content Management, Online Campaign Management, Consumer Segmentation, Targeting, and Positioning using Online Tools, Market Influence Analytics in a Digital Ecosystem	**8**
IV	**Email Marketing**: Email marketing, Building an email list, Creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics, , Content strategy and Planning Mobile Financial Services, Mobile Advertising, Mobile Payment, Mobile Ticketing, Mobile Product Location and Shopping, Mobile Business Services, Mobile Auction, Mobile Entertainment.	**8**

V	Automation in Insurance, Healthcare, Sales Support (Content Access, Inventory), Asset Tracking and Maintenance/Management, Remote IT Support, **DIGITAL MARKETING PROMOTION**: Types of Various Ad Formats: PPC, Banners, Video Ads, App Ads, Facebook advertising, Twitter Advertising, YouTube Advertising, LinkedIn Marketing. Affiliate Marketing, Influence marketing.	**8**

Text Books

1. Advanced E-Commerce and Mobile Commerce, Divakara Reddy N., Suman M., Himalaya Publication house Pvt. Ltd., ISBN 978-93-5202-139-0.
2. Digital Marketing Strategy: An Integrated Approach to Online Marketing, Simon Kingsnorth., second edition, ISBN: 0749484225, Publisher Kogan Page.

Referential Books

1. Digital Marketing, Publisher: Oxford University Press Author: Vandana Ahuja
2. Digital Marketing Strategy, Implementation, and Practice, Dave Chaffey; Fiona Ellis- Chadwick: 11th Edition, Pearson
3. Seema Gupta: Digital Marketing, McGraw Hill Education (India) Private Limited.

Evaluation / Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1. Able to understand the marketing in the digital era.
CO2. Able to understand the business drivers in the virtual world; such as social media, online branding, traffic building on web-site, ecommerce.
CO3. Able to understand the online tools for marketing.
CO4. Able to understand the contemporary digital revolution.
CO5. Able to understand critical thinking and problem-solving skills to real-world digital marketing scenarios.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Information System**
Course Code: 24BCA-204-2	**Title: Information System**

Course Objectives:
CO1: Understand the role of information systems in business operations and strategy.
CO2: Analyze and design information systems that meet organizational needs.
CO3: Gain familiarity with various types of information systems, such as ERP, CRM, and SCM.
CO4: Understand the ethical, legal, and social implications of information systems.
CO5: Explore emerging trends in information systems, such as cloud computing, big data, and cybersecurity.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Information Systems:** Definition and components of Information Systems, The role of IS in business and society, Overview of types of Information Systems, Information Systems in Organizations, Organizational structure and IS, IS for competitive advantage, Information systems management roles and structures.	8
II	**Information and communications technologies:** Communications technologies and networks, the internet. Data storage systems, files and databases. **Data and System Development:** Data Management, Database concepts, Data modeling and design, Introduction to SQL **Information Systems Development:** Information systems development approaches; life cycle, prototyping, incremental models. Systems analysis tasks, methodologies, modelling and agile methods. Data modelling. Systems implementation., System development life cycle (SDLC), Agile and Waterfall methodologies, Tools for IS development.	8
III	**Enterprise Systems:** Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supply Chain Management (SCM) **E-Business and E-Commerce:** E-Business models and strategies, E-Commerce platforms and technologies.	8
IV	**Cloud Computing and Big Data:** Introduction to cloud computing, Big Data technologies and analytics, Impact of cloud and big data on business, Open source software. Social networking.	8

	Cybersecurity and Ethical Issues: Cybersecurity fundamentals, Ethical and legal issues in IS, Data privacy and protection	
V	**Emerging Trends in Information Systems:** Artificial Intelligence and Machine Learning in IS, Blockchain technology, Internet of Things (IoT) and its impact on IS **Information Systems Strategy and Management:** IS strategy alignment with business strategy, IS governance and risk management, Future directions in IS management	8

Text Books:

- Laudon, K.C. and J.P. Laudon. Management Information Systems: Managing the Digital Firm. (New Jersey: Prentice Hall, 2019) sixteenth edition [ISBN 978-0135191798

Reference

- "Information Systems for Business and Beyond" by David T. Bourgeois.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar/Attendance	-
3) Assignments/TA	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcome

CO1: Able to identify role of information systems in business operations and strategy.
CO2: Design information systems that meet organizational needs.
CO3: Gain Knowledge and working with various types of information systems, such as ERP, CRM, and SCM.
CO4: Understand the ethical, legal, and social implications of information systems.
CO5: Able to work in emerging trends in information systems, such as cloud computing, big data, and cybersecurity.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Cloud Computing**
Course Code: 24BCA-204-3	**Title: Cloud Computing**

Course Objectives:

CO1: Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
CO2: Apply the fundamental concepts in datacentres to understand the trade-offs in power, efficiency, and cost.
CO3: Identify resource management fundamentals, i.e., resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
CO4: Analyze various cloud programming models.
CO5: Apply the models to solve problems on the cloud.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	What is cloud? History of Cloud Computing, How Cloud Computing works, Advantages and disadvantages, Application for Businesses, Cloud Service Providers, Cloud Computing Architecture, Cloud Computing Terminology.	8
II	Communication-as-a-Service (CaaS), Infrastructure-as-a-Service (IaaS), Monitoring-as-a Service (MaaS), Software-as-a-Service (SaaS), Platform-as-a-Service (Paas)	8
III	Types of Virtualization & its benefits, Introduction to various Virtualization OS o VMware, KVM etc., Basics Commands, Apache Server, FTP Server, Installing Packages. IIS, FTP Server, Types, Priced and open-source products in the market, overview of Public Cloud vendors, Overview of Private cloud products, Introduction to Amazon Cloud-Pricing, Regions Availability Zones, Types of instances, Overview of different services of AWS, Consuming EC2 Instance Service from AWS (Creating Linux and Window Instances from the available AMIs connecting and remote control from the laptop).	8
IV	Consuming EBS block storage service from AWS-Adding volumes to Instances Taking snapshots, creating volumes from snapshot, attaching volumes to running instances, Using Elastic IP service-Assigning Public IP addresses and connecting from the internet, Installing additional software components on the instances, Automating installing and tasks at the booting time of a instance,	8

	Using the Load Balancers for load distribution(ELB), Installing command line tools, Using clouds watch service, Using Route 53 service, Creating own AMIs.	
V	Virtual Private Cloud- Public and Private Network Scenarios, Using AWS S3 service, Creating a MySQL database using RDS service, IAM-Identity Access Management, Taking backups using command line tools, Understand AWS management tools, including auto scaling, EFS, SNS(Simple Notification System), CDN(Content Delivery Network), Glacier Services, mail Services, Doc Services	8

Text Books:

1. Rajkumar Buyya, "Mastering Cloud Computing", Tata Mc. Graw-Hill Education.
2. Rajkumar Buyya, James Broberg& Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley.

Reference

1. Rajkumar Buyya, "Mastering Cloud Computing", Tata McGraw-Hill Education.
2. Rajkumar Buyya, James Broberg & Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley.
3. Anthony T. Velte, Tobey J. Velte& Robert Elsenpeter, *"Cloud Computing: A Practical Approach*", Tata McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO2: Apply the fundamental concepts in datacentres to understand the trade-offs in power, efficiency and cost.

CO3: Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO4: Analyse various cloud programming models.

CO5: Apply the models to solve problems on the cloud.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Digital Electronics and Computer System Architecture Lab**
Course Code: 24BCA-207P	**Title: Digital Electronics and Computer System Architecture Lab**

Course Objectives:
CO1: Develop a fundamental understanding of digital electronic circuits and systems.
CO2: Provide hands-on experience in designing, building, and testing digital circuits using logic gates, flip-flops, counters, and other basic digital components.
CO3: Familiarize students with different types of digital electronic devices, such as multiplexers, decoders, encoders, and comparators.
CO4: Enhance skills in designing and implementing combinational and sequential circuits to solve practical problems.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=2Credits)

Unit	Contents	No. of Lectures Allotted
I	Implementation of the given Boolean function using logic gates in both sop and pos forms.	2
II	Verification of state tables of RS, JK, T and D flip-flops using NAND & nor gates.	2
III	Implementation and verification of decoder/de-multiplexer and 4 encoder using logic gates.	2
IV	Implementation of 4x1 multiplexer using logic gates.	2
V	Design and verify the 4-bit synchronous counter.	2
VI	Design and verify the 4-bit asynchronous counter.	2
VII	To design and verify operation of half adder and full adder	2
VIII	To design and verify operation of half subtractor.	2

Reference / Text Books:

1. Floyd," Digital Fundamentals", PHI.
2. Morris Mano, "Digital Design", Prentice Hall of India.
3. Tocci.R.J, "Digital Systems-Principles .1 Applications"-Prentice I of India.
4. B. R. Gupta and T.Singhal, "Digital Electronics" 4th Edition, S.K Kataria& sons, India.
5. Fletcher.W.I., "An Engineering Approach to Digital Design", Prentice Hall of India.
6. Millman & Halkias ,"Integrated Electronics".

7. V.K.PURI, "Digital Electronics", TMH.	
Evaluation/Assessment Methodology	
	Max. Marks: 50
1. Class tasks/ Sessional Examination	25
2. Presentations /Seminar	-
3. Assignments	-
4. Practical File /Research Project Report Seminar On Research Project Report	25
5. ESE	-
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Understand the basic principles and concepts of digital electronics, including logic gates, Boolean algebra, and binary number systems.

CO2: Demonstrate proficiency in designing, building, and testing digital circuits using various digital components.

CO3: Analyze and troubleshoot digital circuits using appropriate testing and measurement tools, such as oscilloscopes and logic analyzers.

CO4: Design and implement combinational circuits, such as adders, multiplexers, and encoders, to solve specific problems.

CO5: Design and implement sequential circuits, such as flip-flops, counters, and shift registers, for various applications.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Data Structures**
Course Code: 25BCA-201	**Title: Data Structures**

Course Objectives:
CO1: Remember a brief description of Array data structures.
CO2: Analyze performance of Linked List and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.	8
II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists with implementation, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists.	8
III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deque, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal; Traversal of Binary Trees; Introduction of Binary Search Tree(BST). **Graphs:** Introduction, Terminology, Representation.	9

V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Merge Sort, Heap Sort, Linear Search, Binary Search; Introduction of Hashing.	8

Text Books:

1. Aaron M. Tenenbaum**, "***Data Structures Using C***",** Pearson Education.
2. Samir Kumar Bandyopadhyay, K. N. Dey, "*Data Structures Using C",* Pearson Education.
3. Lipschutz (Schaum's Series), "*Data Structure with C",* Tata McGraw Hill Education.

Reference:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

	Evaluation/Assessment Marks
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: ***Problem Solving using C***

Program Learning Outcomes:

PO1: Remember the need of data structure for writing efficient Programs.
PO2: Analyze the performance of linked list with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structures.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Program: Certificate **Class: BCA**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Structures Lab**
Course Code: 25BCA-206P	**Title: Data Structures Lab**

Course Objectives:
CO1: Remember a brief description of Array data structures.
CO2: Analyze performance of Linked List and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P:2(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Write down difference between Data Type and Data Structure.	1
2.	Differentiate Linear and Non-Linear Data Structure.	1
3.	List operations on Data structure.	1
4.	Explain Linear and multidimensional array with memory implementation in primary memory including concept of row and column major.	1
5.	Give a brief overview of Sparse matrix its memory storage, types and examples.	1
6.	How do traversal work for forward and backward direction in doubly link list.	1
7.	WAP in C language for the Array Implementation of Stack.	1
8.	Write the C function for Push and Pop operations.	1
9.	Represent and analyze the concept of Stack with Link list representation.	1
10.	What are the various operations performed on the Queue?	1
11.	Write an algorithm to insert an element in a circular queue.	1
12.	Explain the different types Graph representations?	1
13.	Write down the Heap sort and give its worst case, best case and average case analysis.	1
14.	Write down the selection sort and give its worst case, best case and average case analysis.	1

15.	What is multilevel indexing in terms of tree indexes?	1
16.	What are the two methods of binary tree implementation? Explain them.	1
17.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.	1
18.	What is multilevel indexing in terms of tree indexes?	1
19.	How many passes are required for the elements to be sorted in quick sort? Explain in detail.	1
20.	Write down the function to insert an element into a queue, in which the queue is implemented as an array.	1
21.	WAP in C language for the Array Implementation of Stack.	1
22.	Write the routine to insert a element onto a queue.	1
23.	Write the complete concept of Linear Search.	1
24.	What are the applications of queue? Explain evaluation of Batch processing.	1
25.	How do you evaluate the Postfix, Prefix and Infix Expressions.	1

Reference / Text Books:

- Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
- E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
- R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

PO1: Remember the need of data structure for writing efficient Programs.
PO2: Analyze the performance of linked list with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structures.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme:BSc/ BA/BBA/BCA/BTech Certificate/Diploma/Degree/ All UG Programme **Class: BCA**	**Year: I** **Semester: II**
Credits: 6 **Theory: 4** **Practical: 2**	**Course: Environment and Ecology**
Course Code: NHU-NPR-112 **NHU-NPR-112P**	**Title: Environment and Ecology** **Environment and Ecology Lab**

Course Objectives:

Subject comprised of various fields of Environmental science and their applications for the mankind. It meets the local to global requirement.

CO1: To appreciate the historical context of human interactions with the environment and to gain insights into the international efforts to safeguard the Earth's environment and resources.
CO2: To understand the concept of natural resources, identify types of natural resources, their distribution and use with special reference to India.
CO3: To develop a critical understanding of the environmental issues of concern
CO4: To describe the main types of ecosystems and their distribution in India and the world and to explain major conservation strategies taken in India.
CO5: To develop an understanding of pollution, its types and Control measures.
CO6: To gain a comprehensive knowledge of climate change, its science and response measures and to have an overview of national and global efforts to address climate change adaptation and mitigation.
CO7: To Explain major conservation strategies taken in India.
CO8: To Sensitize themselves to adverse health impacts of pollution

Nature of Paper: AECC

Minimum Passing Marks/Credits: 40% Marks / 4 Credits
50% Marks / 2 Credits

L: 4
T: 0
P: 1 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Unit	Contents	No. of Lectures Allotted
I	**Humans and the Environment:** The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment, lndic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. Environmental Ethics and emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on	**04**

	Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.	
II	**Natural Resources and Sustainable Development:** Overview of natural resources: Definition of resource; Classification of natural resources-biotic and abiotic, renewable and non-renewable. Biotic resources: Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges. Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water. Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources-coal, oil, natural gas, nuclear energy; Non-conventional energy sources-solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.	**08**
III	**Environmental Issues-Local, regional & Global:** Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Pollution: Impact of sectoral processes on Environment; Types of Pollution-air, noise, water, soil, thermal, radioactive ;municipal solid waste, hazardous waste; transboundary air pollution; acid rain; smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Climate change. Disasters-Natural and Man-made (Anthropogenic).	**08**
IV	**Conservation of Biodiversity & Ecosystem:** Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics• forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.	**08**

V	**Environmental Pollution & Health:** Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants-carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and sulphur dioxide; Other important air pollutants-Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.	**08**
VI	**Climate change: impacts, adaptation & mitigation:** Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions-past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change. Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and *Intended Nationally Determined Contributions* (INDCs); Climate justice.	**08**
VII	**Environment management:** Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 5 lA (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001. Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis. Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management-Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling/Ecomark	**08**

	scheme	
VIII	**Environmental Treaties and Legislation:** An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and non• binding measures; Conference of the Parties (COP) Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgements Major International organisations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.	**08**

Reference / Text Books:

1. A text book of Ecology and Environment, P.C. Joshi & Namita Joshi, Himalaya Publishing House, Mumbai
2. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
3. Ecology and Environment, H.R. Singh and Neeraj Kumar, Rastogi Publication.
4. Fundamentals of Ecology, E.P. Odum, W.B. Saunders Co., Philadelphia.
5. Essentials of Ecology & Environmental Science, S.V.S. Rana, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Fisher, Michael H. (2018) An Environmental History of India-From Earliest Times to the Twenty-First Century, Cambridge University Press.
7. Wildlife Biology. Rajesh Gopal. Approved By MoEF, New Delhi.

If the course is available as Generic Elective then the students of following departments may opt it.
NO

Prerequisite: Intermediate/Basic knowledge of life science

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	16
2) Presentations /Seminar/Attendance	-
3) Assignments	5
4) Research Project Report Seminar On Research Project Report	4
5) ESE	75
Total:	**100**

Prerequisites for the course: Knowledge of Basics of Environment and Ecology (Intermediate level)

Course Learning Outcomes:

CLO1**:** Student will come up with the knowledge of field Environmental management as well as Sustainable development and benefit of mankind.
CLO2**:** Student will come up with the knowledge of Environment management.
CLO3**:** Student will come up with the knowledge of Environmental Science in cleaning the environment.
CLO4: Student will be Explain sustainable development, its goals, targets, challenges and global strategies for sustainable development.
CLO5:Student will be develop a critical understanding of the environmental issues
CLO6: The overall course outcome focused on the role of Environment management in human welfare.
CLO7: Student will be Explain major conservation strategies taken in India.
CLO8: Student will be able Sensitize themselves to adverse health impacts of pollution.

Instructional Method and Pedagogy

1. Preconditioning of the course and its blueprint shall be discussed in the beginning of the course.
2. Various teaching aids are used for smooth conduction of Lectures.
3. 75% attendance in academic sessions is mandatory.
4. Assignments shall be given at the end of each unit/topic. Extempore activity can also be organized on various topics.
5. PPT presentation method is also incorporated in teaching.
6. Case-study based learning will also be used.
7. Promotion of Ex-situ and In-situ learning.
8. Teaching-learning via organizing seminars, guest lectures, invited talks, symposium etc.
9. Identification of slow and fast learners also done during the course commencement.
10. For Slow learners, there is a provision of arrangements of extra classes/weakened classes/remedial classes for their improvement in academics. .
11. For fast learner students, extra exposure to field visit, guest lectures on advanced topics are incorporated.

PRACTICALS

NHU-NPR-112P: Environment and Ecology Lab

Marks: 50 (35 + 15) **Duration: 30 hours (1 credits)**

Case studies and fieldwork

The students are expected to be engaged in some of the following or similar identified activities:

1. Discussion on one national and one international case study related to the environment and sustainable development.

2. Field visits to identify local/regional environmental issues make observations including data collection and prepare a brief report.
3. Participation in plantation drive and nature camps.
4. Documentation of campus biodiversity.
5. In-situ and Ex-situ Conservation Methods of Biodiversity.

ASSESSMENT FOR PRACTICAL

Internal Assessment	**Marks**	**External Assessment**	**Marks**
Lab Performance/ Filed Work	5	Major Experiment/ Case studies	8
Quiz/ Env. Diary	5	Minor Experiment/ Case studies	6
Charts/ Model	5	Spotting	10
-	-	Viva	6
-	-	Record	5
Total	**15**	**Total**	**35**

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Data Structure and Algorithms using 'C'**
Course Code: 25BCA-301	**Title: Data Structure and Algorithms using 'C'**

Course Objectives:

CO1: Remember an introduction of major algorithms and brief description of Array data structures.
CO2: Analyze performance of Linked List algorithms and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue algorithm and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.	8
II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists.	8
III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deque, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal; Traversal of Binary Trees; Application of Binary Trees;	8

	Binary Search Tree (BST), Insertion and Deletion in BST, B-Tree.	
V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Merge Sort, Heap Sort, Linear Search, Binary Search and Hashing.	8

Text Books:

1. Aaron M. Tenenbaum, "Data Structures Using C", Pearson Education.
2. Samir Kumar Bandyopadhyay, K. N. Dey, "Data Structures Using C", Pearson Education.
3. Lipschutz (Schaum's Series), "Data Structure with C", Tata McGraw Hill Education.

Reference

1. Robert Kruse, C. L.Tondo, "Data Structures and Program Design in C" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "Fundamentals of Data Structures", Galgotia Publications.
3. R. S. Salaria, "Data Structures & Algorithms", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology	**Evaluation/Assessment Marks**
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: ***Problem Solving using 'C'***

Program Learning Outcomes:

PO1: Remember the need of data structure and Algorithms for writing efficient Programs.
PO2: Analyze the performance of linked list algorithms with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structure Algorithm.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Program: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Structure and Algorithms using 'C' Lab**
Course Code: 25BCA-301P	**Title: Data Structure and Algorithms using 'C' Lab**

Course Objectives:

CO1: Remember an introduction of major algorithms and brief description of Array data structures.
CO2: Analyze performance of Linked List algorithms and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue algorithm and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L:0
T:0
P:2(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	What is an algorithm?	1
2.	Write down difference between Data Type and Data Structure.	1
3.	Differentiate Linear and Non-Linear Data Structure.	1
4.	List operations on Data structure.	1
5.	Explain Complexity.	1
6.	Define Big 'O notation.	1
7.	Define Time space Trade off.	
8.	Declare and Initialize Linear array.	1
9.	Write 4*4 sparse matrix.	1
10.	Write about Linked List.	1
11.	Define Data Structure, its Types and their Brief Explanation.	1
12.	What are the measures of an efficiency of an algorithm? Explain.	1
13.	Explain Linear and multidimensional array with memory implementation in primary memory including concept of row and column major.	1
14.	What do you understand by Insertion and deletion in Linear array, explain their Algorithms.	1

15.	Give a brief overview of Sparse matrix its memory storage, types and examples.	1
16.	What do you understand by complexity of an algorithm? Write down Time and Space complexity and Explain time space trade-off.	1
17.	Write an algorithm for List Creation and Traversal.	1
18.	Explain node deletion algorithms for doubly link list	1
19.	Explain the different types Graph representations?	1
20.	How many passes are required for the elements to be sorted in insertion sort? Explain in detail.	1
21.	What are the two methods of binary tree implementation? Explain them.	1
22.	Write an algorithm for Depth First Search and explain steps of algorithm with suitable example.	1
23.	Explain the situation for collision and overflow area.	1
24.	Write an algorithm for Breapth First Search and explain steps of algorithm with suitable example.	1
25.	Explain the steps of deletion in BST.	1
26.	What is multilevel indexing in terms of tree indexes?	1
27.	What are the two methods of binary tree implementation? Explain them.	1
28.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.	1
29.	Write an algorithm to split a node in a B-Tree.	1
30.	Explain the differences between AVL Tree and BST.	1
31.	Explain the Prims algorithm with suitable example.	1
32.	How many passes are required for the elements to be sorted in quick sort? Explain in detail.	1
33.	Write an algorithm for Bellman Ford and explain some steps with suitable example.	1
34.	Write an algorithm Warshal algorithm and apply the steps of algorithm using suitable example.	1
35.	Explain the Straseen's Algorithm and apply the steps with suitable example.	1
36.	Explain all Greedy Programming approaches.	1
37.	Explain all pair shortest path with an example.	1
38.	Explain Longest Common Sub-Sequence Greedy Programming with an example.	1
39.	Write down the merge sort algorithm and give its worst case, best case and average case analysis.	1
40.	Write down the quick sort algorithm and give its worst case, best case and average case analysis.	1

Reference / Text Books:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Learning Outcomes:

CO1: Remember the need of data structure and Algorithms for writing efficient Programs.
CO2: Analyze the performance of linked list algorithms with its versatile applications.
CO3: Develop and analyze real time application programs with concept of Stack and Queue.
CO4: Remember the conceptual and practical implementation of Major Tree Data Structure Algorithm.
CO5:Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.PO3: Students can learn Complete Programming Concepts of Arrays.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester- III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Operating System**
Course Code: 25BCA-302	**Title: Operating System**

Course Objectives:

1. Analyze and evaluate the structure, functions, and types of operating systems, including their components and services.
2. Analyze and evaluate the functioning of processes and process scheduling in operating systems, including process states, context switching, threads, and scheduling algorithms.
3. To Analyze and evaluate process synchronization and deadlock handling techniques.
4. To enable students to understand and analyze memory management techniques including logical and physical address spaces, paging, segmentation, fragmentation, and virtual memory concepts.
5. Apply and analyze the concepts of file systems, disk, and I/O management to design and evaluate efficient storage and input/output subsystems in an operating system.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0
Theory - 1 Hr. = 1 Credit
Credit (4 Hrs./Week = 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Overview of Operating Systems**: Definition of Operating System, Types of Operating Systems-Batch, Time-Sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, OS Operations, OS Services, role of an Operating system as a resource manager, Spooling, System Calls and its types, Kernel, Shell, Device drivers, OS Structures-Layered, Monolithic, Microkernel Operating Systems.	8
II	**Processes:** Definition of Process, processes address space, Principle of Concurrency, Process States, Operations of Processes, Process State Transitions, Process Control Block, Context Switching, processes involved in context switching, Threads and their management, advantages of threads, types of threads, Concept of Multithreads **Process Scheduling:** Scheduling Objectives, Scheduling criteria, Preemptive and Non-Preemptive Scheduling, Types of Schedulers, Difference between Long term and short-term Scheduler, Dispatcher, Scheduling Criteria, Scheduling Algorithms, Multi-processor Scheduling.	8
III	**Process Synchronization:** Mutual exclusion, Critical section, Critical Section Problem, Two Process Solution, Semaphores, Classical Problem of	8

	Synchronization- Bounded Buffer Problem, Producer Consumer Problem and Dinning Philosopher Problem. **Deadlock**: Deadlock Characterizations, Conditions for deadlock, Resource Allocation Graph, Safe state, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Differentiate between deadlock prevention and avoidance, Deadlock Detection, Recovery from Deadlock.	
IV	**Memory Management:** Requirement of memory management, Logical versus Physical Address Space, Swapping, Paging, Fragmentation and its types, Compaction, Segmentation **Virtual Memory:** Virtual Memory and its advantages, Hardware and Control Structures, Demand Paging and its advantages, Page Fault, Page Replacement, Page-Replacement Algorithms, Thrashing, Causes of thrashing.	8
V	**File System**: File, Directory, File attributes, File operations, Types of files, Access Methods, Allocation Methods, File System Structure, Directory Structures and Protection, Free-Space Management. **Disk Management:** Disk Structure, Disk Scheduling Algorithm, Swap-Space Management. **I/O Management:** Principles of I/O Hardware-I/O devices, Types of Devices, Buffering and its types, Pooling, Device Controllers, Interrupt Handlers, Direct Memory Access.	8

Text Books:

1. Silberschatz and Galvin, "*Operating System Concepts*", John Wiley & Sons.
2. "Principles of Operating Systems" Author: Brian L. Stuart.
3. "Understanding Operating Systems" Authors: Ann McHoes, Ida M. Flynn.
4. "Operating Systems: Internals and Design Principles "Author: William Stallings.

Reference

1. Madnick& Donovan, "*Operating Systems*", Tata McGraw Hill.
2. Modern Operating Systems Author: Andrew S. Tanenbaum
3. Operating Systems: Internal and Design Principles
   Author: William Stallings

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Basic knowledge of Operating System and its working.

Course Learning Outcomes:

CO1. Students will be explaining the fundamental concepts, types, operations, and structures of operating systems, and apply this knowledge to identify the role of the OS in managing system resources and processes.

CO2. Students will be able to analyze and apply key operating system concepts related to process management and scheduling, including process states, process control blocks, context switching, thread management, and various scheduling algorithms, to design efficient and concurrent process scheduling systems in multiprocessor environments.

CO3. Students will be able to analyze and apply concepts of process synchronization and deadlock management, including critical sections, semaphores and deadlock characterization, prevention, avoidance, detection, and recovery techniques, to design and evaluate concurrent systems that ensure safe and efficient resource allocation.

CO4. Students will be able to analyze and evaluate various memory management techniques, including logical and physical address mapping, paging, segmentation, and virtual memory concepts, to effectively manage memory resources and optimize system performance.

CO5. Students will learn and explain the structure and management of file systems, disk management techniques, and I/O management principles, including device handling and data transfer methods, to effectively design and optimize operating system components.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Operating System Lab**
Course Code: 25BCA-302P	**Title: Operating System Lab**

Course Objectives:
CO1: To Implement the Banker Algorithm using C program
CO2: To implement various Page Replacement Algorithms.
CO3: To implement CPU Scheduling Algorithms and memory management algorithms.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write C programs to implement the FIFO (First-In-First-Out) Page Replacement Algorithm.	2
II	Write C programs to demonstrate Creating a New Process Using fork ().	2
III	Write C programs to implement the SJF CPU Scheduling Algorithms.	2
IV	Write C programs to simulate CPU scheduling algorithms: SJF and Round Robin to calculates waiting time and turnaround time for processes.	2
V	Implement the Contiguous File Allocation Strategies using C programs.	2
VI	Write C programs to simulate solutions to Classical Process Synchronization Problems.	2
VII	Write C programs for the implementation of SCAN disk scheduling algorithm.	2
VIII	Write a C program to implement Bankers Algorithm.	2

Reference / Text Books:

1. 1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7 the edition, Wiley India Private Limited, New Delhi.
2. "Principles of Operating Systems" Author: Brian L. Stuart.
3. "Operating Systems: Internals and Design Principles "Author: William Stallings.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report	-
Seminar On Research Project Report	
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Identify the performance of various page replacement algorithms.

CO2: Develop banker algorithm for deadlock avoidance.

CO3: Choose the best CPU scheduling algorithm for a given problem instance.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Database Management System**
Course Code: 25BCA-303	**Title: Database Management System**

Course Objectives:

CO1: Define the key concepts of a Database Management System (DBMS) and its components, comparing it with traditional file systems.
CO2: Apply relational data model concepts to real-world database scenarios, identifying and differentiating between primary, candidate, foreign, and super keys.
CO3: Execute SQL queries to manipulate and retrieve data, utilizing various SQL commands (INSERT, UPDATE, DELETE, SELECT) and aggregate functions.
CO4: Evaluate the use of joins, Define key terms Analyze functional dependencies and apply normalization techniques to ensure data integrity.
CO5: Evaluate transaction systems by analyzing serializability, recoverability, and deadlock handling in database environments

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Data Base:** Introduction, Database System vs File System, Characteristics of DBMS, Advantages & Disadvantages of DBMS, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Overall Database Structure. Data Modelling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints.	8
II	**Relational data Model & Keys:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints. Keys, Concepts of Super Key, Candidate Key, Primary Key, Foreign Key, Generalization, Aggregation and Reduction of an ER Diagrams to Tables.	8
III	**Introduction to SQL:** Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views, and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, and Unions, Intersection, Minus, Cursors, Triggers and Procedures in SQL/PL SQL.	8

IV	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.	8
V	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.	8

Text Books:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill.
2. Date C J, "An Introduction to Database Systems", Addision Wesley.
3. Elmasri, Navathe, "Fundamentals of Database Systems", Addision Wesley.
4. O'Neil, "Databases", Elsevier Pub

Reference

1. Ramakrishnan, "Database Management Systems", McGraw Hill.
2. Leon & Leon, "Database Management Systems", Vikas Publishing House.
3. Bipin C. Desai, "An Introduction to Database Systems", Gagotia Publications.
4. Majumdar& Bhattacharya, "Database Management System", McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Students will be able to identify and define core database system components such as data models, schemas, instances, and the concept of data independence.
CO2: Students will be able to demonstrate understanding of relational model, and use of keys.
CO3: Students will demonstrate proficiency in SQL by executing complex queries to manipulate and retrieve data, incorporating aggregate function.
CO4: Students will be able to assess and optimize the use of joins, subqueries, and views in SQL queries.
CO5: Students will be able to analyze data models for functional dependencies and normalize database schemas up to BCNF, ensuring minimal redundancy and maintaining data integrity in database design.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Base Management System Lab**
Course Code: 25BCA-303P	**Title: Data Base Management System Lab**

Course Objectives:
To learn the student should be made to:
CO1: Foundation knowledge in database concepts, technology, and practice to groom students into well-informed database application developers.
CO2: Be familiarized with a query language
CO3: Have hands on experience on DDL Commands

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Creation of a database and writing SQL queries to retrieve information from the database.	2
II	Performing Insertion, Deletion, Modifying, Updating and Viewing records based on conditions.	2
III	Perform the following: a. Viewing all databases, creating a Database, viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting b. Records in a Table, Saving (Commit) and Undoing (rollback).	2
IV	Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, backing up / restoring a Database.	2
V	For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer Join Sub queries- With IN clause, With EXISTS clause.	2
VI	For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting from view.	2

VII	Write a Pl/SQL program using FOR loop to insert ten rows into a database table.	2
VIII	Given the table EMPLOYEE (Emp No, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.	2

Reference / Text Books:

1. Fundamentals of Database System ByElmasari& Navathe, 7th Edition, 2018, Pearson Education.
2. Database System Concepts by Silberschatz, Korth& Sudarshan, 6th Edition, 2019, McGraw-Hill Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Design and implement a database schema for a given problem-domain

CO2: Populate and query a database

CO3: Create and maintain tables using PL/SQL.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Blockchain**
Course Code: 25BCA-304-1	**Title: Blockchain**

Course Objectives:
CO1: Study and understand basic concepts of Blockchain basics.
CO2: Learn about various consensus protocol used in Blockchain.
CO3: Evaluate and learn about cryptocurrency.
CO4: Learn about various security features of Blockchain.
CO5: Evaluate Blockchain Technology used in different areas.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction of Blockchain**: Foundation of Blockchain, Features of Blockchain, Need of Blockchain, Component of Blockchain, Public blockchains, Permissioned blockchains, Private blockchains, The Structure of Blockchains, The Blockchain Life Cycle, Blockchain architecture, Blockchain-as-a-Service.	8
II	**Consensus Algorithm:** Introduction of Consensus, Proof of Work (PoW), Proof of State (PoS), Proof of Authority (PoA), Hash functions, Merkle Tree, Nonce in Blockchain.	8
III	**Cryptocurrency:** Blockchain version; Currency, Smart Contracts, Dapps, History of the Bitcoin Blockchain, History of the Ethereum Blockchain, History of the Ripple Blockchain, Myth about Cryptocurrency.	8
IV	**Privacy And Security Techniques Used in Blockchain:** Hyperledger, Cryptography in Blockchain: Symmetric Cryptography, Asymmetric Cryptography, Cryptographic Hash, how security differs by blockchain types?, Keys in Cryptography.	8
V	**Blockchain Uses:** Financial Services, Medical and healthcare, Blockchain city, Education Services.	8

Text Books:
1. Mark Gates, "Blockchain-Ultimate Guide to Understand blockchain," Wise Fox Publishing.
2. Vikram Dhillon, David Metcalf, Max Hooper "**Blockchain Enabled Applications"** Apress.

Reference

<table>
<tr><td colspan="2">1. Tiana Laurence, “Blockchain For Dummies,”, John Wiley & Sons, Inc.
2. Melanie Swa, “Blockchain”, O’ Reilley.</td></tr>
<tr><td colspan="2">Evaluation/Assessment Methodology</td></tr>
<tr><td></td><td>Max. Marks 100</td></tr>
<tr><td>1) Class tasks/ Sessional Examination
2) Presentations /Seminar
3) Assignments
4) Research Project Report
Seminar On Research Project Report
5) ESE</td><td>15
-
10
-

75</td></tr>
<tr><td>Total:</td><td>100</td></tr>
<tr><td colspan="2">Course Learning Outcomes:
CO1: Explain how a blockchain records and verifies transactions.
CO2: Contribute to the development of new blockchain protocols or standards.
CO3: Simulate crypto currency transactions on a test network.
CO4: Able to explain about Hyper ledger used in Blockchain technology.
CO5: Compare and contrast different blockchain platforms and their suitability for specific applications.</td></tr>
</table>

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Data Mining & Data Warehousing**
Course Code: 25BCA-304-2	**Title: Data Mining & Data Warehousing**

Course Objectives:
CO1: To Understand data warehousing components, architecture, and OLAP concepts.
CO2: To Comprehend data mining fundamentals, functionalities, and major issues.
CO3: To Explore classification, prediction, and association rule mining algorithms
CO4: To Learn various clustering methods including partitioning, hierarchical, and density-based approaches.
CO5: To Understand mining of complex data objects, spatial, multimedia, text, and web data.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Data Warehousing** Overview and Concepts: Data Warehousing Components, Building a Data Warehouse, Data Warehouse Architecture, Data Extraction, Cleanup, and Transformation Tools, Metadata, Reporting, Query tools and Applications, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.	8
II	**Data Mining** Introduction: Fundamentals of Data Mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Major issues in Data Mining. Data Pre-processing, Need for Pre-processing the Data, Data Cleaning, Data Integration & Transformation, Data Reduction, Decentralization and Concept Hierarchy Generation	8
III	**Data Mining Techniques** Classification and Prediction:- Issues Regarding Classification and Prediction, Classification by Decision Tree, Bayesian Classification, Rule Based Classification, Association Rule Mining, Efficient and Scalable Frequent Itemset Mining Methods, Market Basket Analysis, Apriori Algorithm, Tree Based Algorithms, Prediction – Regression Models, Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor	8
IV	**Cluster Analysis** Clustering Overview, A Categorization of Major Clustering Methods,	8

	Partitioning Methods, Hierarchical Methods, Partitioning Clustering-K-Means Algorithm; Basic Agglomerative Hierarchical Clustering Algorithm, Key Issues in Hierarchical Clustering, Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods- Neural Network Approach, Outlier Analysis.	
V	**Mining Object, Spatial, Multimedia, Text and Web Data:** Mining the World Wide Web, Multimedia Data Mining, Text Mining, Web Content Mining, Web Structure Mining, Web Usage Mining Data Analysis and Visualization: Correlation, Covariance, Rank and Percentile.	8

Text Books:

1. Jiawei Han, Jian Pei, Micheline Kamber, *"Data Mining: Concepts and Techniques"*, Elsevier.
2. Margaret H. Dunham, "*Data Mining: Introductory and Advanced Topics",* Pearson Education.
3. Arun K. Pujari, *"Data Mining Techniques"*, Universities Press
4. Pieter Adriaans&DolfZantinge, *"Data Mining"*, Pearson Education

Reference

1. "Introduction to Data Mining" by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar
2. "*Data* Warehousing, Data Mining, and OLAP" by Alex Berson and Stephen Smith

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Student is able to design data warehouse schemas and apply OLAP techniques for data analysis.
CO2: Student is able to perform data pre-processing steps like cleaning, integration, and reduction
CO3: Student is able to apply decision trees, Bayesian classification, and Apriori algorithm to real-world problems
CO4: Student is able to implement K-Means, hierarchical clustering, and DBSCAN algorithms.
CO5: Student is able to analyze and visualize data using advanced charts and reporting tools.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 2 **Theory: 2** **Practical: 0**	**Course: R-Programming**
Course Code: 25BCA-305	**Title: R-Programming**

Course Objectives:

CO1: To introduce participants to the R programming language and its environment
CO2: To equip learners with the skills to manipulate data, perform statistical analyses, and create visualizations using R.
CO3: To provide participants basics of function and programming loops.
CO4: To provide insights into advanced data analysis techniques, including machine learning algorithms within the R ecosystem.
CO5: To foster the ability to tackle real-world data problems and derive actionable insights using R.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 40% Marks / 2 Credits (Internal +ESE)

L: 2
T: 0
P: 0 (In Hours/Week)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to R Programming**: Overview of R and its IDEs (RStudio), Basics of R syntax and programming concepts, Installing a R Package, Few commands to get started: installed. packages(), package Description(), help(), find. package(), library() - Input and Output – Entering Data from keyboard.	6
II	**R Data Types:** Vectors, Lists, Matrices, Arrays, Factors, Data Frame. **R - Variables:** Variable assignment, Data types of Variables, Finding Variable, Deleting Variables. **R Operators:** Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators.	6
III	**R Decision Making:** if statement, if – else statement, if – else if statement, switch statement.**R Loops:** while loop, for loop - Loop control statement: break statement, next statement **R-Function:** function definition, calling a function **Built in functions:** mean(), paste(), sum(), min(), max(), seq(), user-defined function.	6
IV	**R-Strings** – Manipulating - R Vectors – Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting R List - Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, - R Matrices – Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division- R Arrays: , Accessing Array Elements, Manipulating Array Elements, - R Factors –creating factors. **String functions :** grep(), nchar() , paste(), sprintf(), substr(), strsplit(), regex()	6

	gregexpr(), toupper(), tolower(), paste() Solving problems from assignment sheet.	
V	Data Frames –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() –Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir() - Writing into a CSV File – R -Excel File – Reading the Excel file.	6

Text Books Reference

1. "The Book of R" by Tilman M. Davies, no starch press(San Francisco)
2. "The Art of R programming" by Norman Matloff, no starch press(San Francisco)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination)	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Demonstrate proficiency in R programming basics, including data types, functions, and control structures.
CO2: Able to perform function and programming loops.
CO3: Able to create basic data frames and represent data.
CO4: Able to manipulate and read data automatically.
CO5: Develop and implement R scripts and functions to automate data analysis tasks, enhancing productivity and ensuring reproducibility.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: R-Programming Lab**
Course Code: 25BCA-305P	**Title: R-Programming Lab**

Course Objectives:
To learn the student should be made to:
CO1: Introduction to Basic R environment.
CO2: Implement R script to show the usage of various operators available in R language.
CO3: Implementation of basic building of logic and functions.
CO4: Implement R Script to create a list and access data from list.
CO5: Basics of scripting and performing various operations on vectors.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (ESE + Internal)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	R basics, Installation, Data types and Functions	2
II	Implement R script to show the usage of various operators available in R language.	2
III	Implement R script to perform various operations on vectors	2
IV	Implement R script to find biggest number between two numbers.	2
V	Implement R Script to create a list.	2
VI	Implement R Script to access elements in the list.	2
VII	Implement R Script to perform matrix operation.	2
VIII	Implement R script to read person‘s age from keyboard and display whether he is eligible for voting or not.	2

Reference / Text Books:
1. Fundamentals of Database System by Elmasari & Navathe, 7th Edition, 2018, Pearson Education.
2. Database System Concepts by Silberschatz, Korth & Sudarshan, 6th Edition, 2019, McGraw-Hill Education.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-

4) Research Project Report Seminar On Research Project Report 5) ESE	- 25
Total:	50

Course Learning Outcomes:
Student will be able to:
CO1: Design and implement basics of R Programming
CO2: Populate and implement basic operation and simple logic building
CO3: Create and maintain tables, list and vectors and access data.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Cyber Security**
Course Code: 25BCA-306	**Title: Cyber Security**

Course Objectives: Upon successful completion of this course, students will be able to:

CO1: Understand the foundational concepts of cyberspace and the internet's architecture.
CO2: Identify and analyze various forms of cybercrime and the legal frameworks designed to combat them.
CO3: Recognize security threats associated with social media and apply best practices for safe online interaction.
CO4: Comprehend the security aspects of e-commerce and digital payment systems, including common frauds and preventive measures.
CO5: Implement essential security measures for digital devices and utilize basic cybersecurity tools and technologies.

Nature of Paper: VAC

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	8
II	Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.	8
III	Social Media Overview and Security: Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to	8

	social media, Flagging and reporting of inappropriate content, Laws, regarding posting of inappropriate content, best practices for the use of social media, Case studies.	
IV	E–Commerce and Digital Payments: Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007,	8
V	Digital Devices Security, Tools, and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	8

Text Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
2. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
3. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
5. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

Reference

1. Fundamentals of Network Security by E. Maiwald, McGraw Hill..
2. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: After completion of this module, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2: Students, at the end of this module, should be able to understand the cyber-crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content,

underlying legal aspects and best practices for the use of Social media platforms.
CO4: After the completion of this module, students would be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.
CO5: Students, after completion of this module will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: OOPs Using Java**
Course Code: 25BCA-401	**Title: OOPs Using Java**

Course Objectives:
CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of abstraction.
CO4: Able to understand the use of Packages and Interface in java.
CO5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to OOPs and Java:** OOPs Concepts, Top-Down Approach and Bottom Up Approach, Introduction to Java, History of Java, Features of Java, Byte Code, JVM, JRE, JDK, JIT, Java Applications, Character Set, Identifiers, Literals, Comments, Keyword, Data Type, Operators, Conditional Statements, Looping Statements, Array Declaration, Creation, Initialization. **String Handling:** Predefined Functions in String, String Methods, Command-Line Arguments.	8
II	**Classes, Objects and Methods:** Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors, Types of Constructors, this, super & static keyword, Inheritance, Types of Inheritance, Method Over Loading & Overriding, final keyword, Abstract Class.	8
III	**Interfaces and Packages:** Defining Interfaces, Extending and Implementing Interfaces, Defining Packages, Access Protection, Importing Packages, **Exception Handling:** Exception Types, Multiple Catch Clauses, Nested Try Statements, Throw, Throws, Finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.	8
IV	**Multithreaded Programming:** Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority, Runnable interface. **Managing I/O Files:** Introduction, Streams, Stream Classes, File Class, Creation of Files, Reading and Writing to File.	8

V	**GUI Programming and Event Handling:** AWT, Swing, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like JButtons, JCheck Boxes, JRadio Buttons, JLabels, JText Fields, JText Areas, JCombo Boxes, Sliders, Windows, Menus, Dialog Box, Event handling in java, Event types, Mouse, and key events. **Connecting to Database:** JDBC Type 1 to 4 drivers, connecting to a database, querying a database, and processing the results, updating data with JDBC.	8

Text Books:

1. Patrick Naughton and Herbertz Schildt, "Java-2 The Complete Reference", McGraw Hill.
2. Ivor Horton, "Beginning Java-2", Wiley Publishing.
3. Balaguruswamy, "Programming with Java: A Primer", Tata McGraw Hill Education.

Reference:

1. Horetmann Cay and Cornell Gary, "Core Java Volume – I", Pearson Education.
2. Horetmann Cay and Cornell Gary, "Core JavaTM 2, Volume II – Advanced Features", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of abstraction.
CO4: Able to understand the use of Packages and Interface in java.
CO5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: OOPs using Java Lab**
Course Code: 25BCA-401P	**Title: OOPs using Java Lab**

Course Objectives:
CO 1: Understand and apply the fundamental concepts of Object-Oriented Programming using Java.
CO 2: Solve real-world problems using Java classes, objects, inheritance, and polymorphism.
CO 3: Apply abstraction, interfaces, and packages to develop modular programs.
CO 4: Implement robust Java applications using exception handling and multithreading.
CO 5: Create GUI-based applications and perform file/database operations using Java I/O and JDBC.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction, Basic Syntax, and Control Structures:** 1. Write a Java program to display "Hello, World!" using command-line arguments. 2. Develop a Java program for simple arithmetic operations using control statements. 3. Implement a Java program to demonstrate usage of loops (for, while, do-while). 4. Write a Java program to check whether a string is a palindrome using String methods.	3
II	**Introduction, Basic Syntax, and Control Structures:** 1. Write a Java program to use ***static and super*** keyword. 2. Implement a Java program to demonstrate usage of **constructor.** 3. Implement a Java program to demonstrate usage of **abstract classes.** 4. Implement a Java program to demonstrate usage of **Inheritance**	3
III	**Interfaces, Packages, and Exception Handling:** 1. Write a program to create and use user-defined packages. 2. Develop an application using interfaces and multiple inheritance. 3. Create a program demonstrating try, catch, finally, throw, and throws. 4. Develop a custom exception class and use it in a program to handle user-defined exceptions.	3

IV	**Multithreading and File I/O:** 1. Write a program to create threads using Thread class and Runnable interface. 2. Implement thread synchronization using synchronized methods. 3. Write a Java program to create and write to a file using File Output Stream. 4. Develop a program to read content from a file and display it using Buffered Reader.	3
V	**GUI Programming and Database Connectivity:** 1. Create a simple GUI form using Swing components such as J Button, J Label, J Text Field, etc. 2. Write a Java program using Swing to build a calculator application. 3. Develop a program to connect to a MySQL database using JDBC and retrieve data. 4. Implement insert, update, delete operations in a database using JDBC.	3

Text Books /Reference:

1. Patrick Naughton and Herbertz Schildt, "Java-2: The Complete Reference", McGraw Hill.
2. E. Balaguruswamy, "Programming with Java: A Primer", Tata McGraw Hill Education.
3. Cay S. Horstmann & Gary Cornell, Core Java Volume I & II, Pearson Education.
4. Ivor Horton, *Beginning Java 2*, Wiley Publishing.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Develop and test Java programs using object-oriented features like classes, objects, and constructors.

CO2: Implement inheritance, method overloading/overriding, and abstraction.

CO3: Apply interfaces, packages, and exception handling mechanisms in Java programs.

CO4: Develop multithreaded applications and perform file I/O operations in Java.

CO5: Design GUI-based applications with AWT/Swing and integrate database operations using JDBC.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Software Engineering**
Course Code: 25BCA-402	**Title: Software Engineering**

Course Objectives:

CO1: Introduce and apply various software development process models, enabling students to select the most appropriate model based on project needs.
CO2: Develop the ability to gather, analyze, and document software requirements for different kinds of software systems using industry standards.
CO3: Impart foundational knowledge of software architecture and design principles.
CO4: Familiarize students with essential concepts in software project management, including cost estimation, scheduling, and progress tracking.
CO5: Equip students with practical knowledge of software testing and debugging techniques, and the ability to assess their effectiveness in real-world scenarios.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction: Software- Characteristics and Applications, Software Engineering, Software Engineering Layers, Software Process Framework, CMM, Software Quality Attribute and Metrics, Software Development Life Cycle, Software Process Models Water Fall Model, Prototyping Model, RAD Model, Spiral Model, Evolutionary Models, Component-based Development Model.	8
II	Software Requirements Engineering and Analysis Modeling: Software Requirements, Requirement Engineering Process, Elicitation Requirements, Analysis and Negotiating Requirements, Requirement Specification, System Modeling, Requirements Validation, Requirement Management, Creating a Software Requirements Specification Document, IEEE Standards for SRS, Feasibility Study, Elements of Analysis Model, Data Modeling-ER Diagram, Information Modeling-DFD, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.	8
III	Software Design and Implementation: Design Process, Principles, and Design Concepts-Abstraction, Architecture, Refinement, Modularity, Data Structure, Information Hiding, Functional Independence, Cohesion, Coupling; Design Documentation, Design Strategies-Top Down and Bottom Up Design; Design	8

	Model Data Design Elements, Architectural Design, User Interface Design, Component-Level Design, Deployment-Level Design, Implementation Issues and Programming Support Environment.	
IV	Software Testing: Verification, Validation, Testing Objectives, Unit Testing, Integration Testing, Validation Testing, System Testing, Acceptance Testing, Regression Testing, Test Characteristics, White Box Testing, Basic Path Testing, Control Structure Testing, Black Box Testing, Test Plan, Test Case Design, Quality Metrics for Testing.	8
V	Software Maintenance: Nature and Need of Maintenance, Types of Maintenance (Perceptive, Preventive, Adoptive, Corrective), Cost of Maintenance, Evolution of Software, Software Maintenance Process, Software Maintenance Techniques-Reverse Engineering, Reengineering; Factors affecting Software Maintenance, Key Issues in Maintenance, Software Configuration Management, Version and Release Control, Change Control.	8

Text Books:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", Addison Wesley
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer

Reference:

1. K. K. Aggarwal & Yogesh Singh "Software Engineering", New Age International.
2. I. Sommerville, "Software Engineering", Pearson Education.
3. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
4. Subramanian Chandramouli, Saikat Dutt, Chandramouli Seetharaman, B. G Geetha, "Software Engineering", Pearson Education India

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Differentiate between various software process models and justify their use in real-life software projects.
CO2: Construct data flow diagrams (DFDs), entity-relationship diagrams (ERDs), and other models to represent software requirements effectively.
CO3: Create design models including architectural, data, and user interface designs for software systems.
CO4: Design effective test plans and test cases and evaluate testing outcomes using quality metrics.
CO5: Apply maintenance techniques such as reverse engineering and reengineering in evolving software systems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Software Engineering Lab**
Course Code: 25BCA-402P	**Title: Software Engineering Lab**

Course Objectives:
CO1: Solve different types of case diagram.
CO2: Apply white box and black box testing.
CO3: Solve state diagram and activity diagram.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Draw the use case diagram and specify the role of each of the actors. Also state the precondition, post condition and function of each use case	2
II	Preparation of Software Requirement Specification Document and Design Documents.	2
III	Identify the classes. Classify them as weak and strong classes and draw the class diagram.	2
IV	Preparation of Software Configuration Management and Risk Management related documents	2
V	Study and usage of any Design phase CASE tool.	2
VI	Prepare a SRS document in line with the IEEE recommended standards.	2
VII	Develop test cases for unit testing and integration testing.	2
VIII	Develop test cases for various white box and black box testing techniques.	2
IX	Draw the activity diagram	2
X	Draw the state chart diagram.	

Text Books:
- RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
- Pankaj Jalote, Software Engineering, Wiley

Reference Books
- Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
- K.K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report	-
Seminar On Research Project Report	
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Able to solve different types of case diagram.
CO2: Able to apply white box and black box testing on SRS.
CO3: Evaluate state diagram and activity diagram.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Computer Graphics**
Course Code: 25BCA-403	**Title: Computer Graphics**

Course Objectives:
CO1: Solve different types of display techniques.
CO2: Apply Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Solve 2DTransformations and Composition of 3-D Transformation.
CO4: Apply Point, Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm
CO5: Solve Pipeline and Different Types of Projections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic of Computer Graphics, Uses of Computer Graphics, Shadow mask techniques, CRT working, Visual Display Devices-Refresh CRT, Raster-Scan Displays, Random-Scan Displays, Colour-CRT Monitors, DVST, Flat Panel Displays, 3-D Viewing Devices, Stereoscopic and Virtual-Reality Systems; Raster-Scan System, Random Scan System, Input/ Output Devices, Hard-Copy Devices, Color Models: RGB, CMY, HSV, HLS colour Models.	8
II	**Output Primitives Algorithms:** Scan Conversion: Point, Line, Circle, Ellipse, Polygon; Filled area Algorithms: Scan-line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood-Fill Algorithm, Aliasing, and Introduction to Anti-Aliasing.	8
III	**Geometric Transformations:** 2-Dimensional Transformations (Translation, Rotation, Scaling, Reflection, Shear, Inverse Transformation, Composite Transformation, Homogeneous Coordinates and Matrix Representation, Matrix Representation of 3-D Transformations, Composition of 3-D Transformation.	8
IV	**Two-Dimensional Viewing and Clipping:** Viewing Pipeline, The Window-to-View port Transformations, Convex and Concave Clipping, Point Clipping, Line Clipping-Cohen-Sutherland Polygon Clipping, Liang-Bar sky Line Clipping, Cyrus-Beck Algorithm, Midpoint Sub division Algorithm; Sutherland-Hodgeman Polygon clipping.	8
V	**Three-Dimensional Viewing and Clipping:** Viewing Pipeline, Projections, Types of Projections, The Mathematics of Planner Geometric Projections,	8

	Parametric Representation of Curves: Bezier Curves, B-Spline Curves, Z-Buffer algorithm, Scan Line Algorithm, Area subdivision algorithm	

Reference:

1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press.
2. John Vince, "*Mathematics for Computer Graphics",* Springer.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Learned and solved different types of display techniques.
CO2: Learned and Solved concepts of Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Learned and Solved 2DTransformations and Composition of 3-D Transformation.
CO4: Applied Point, Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm.
CO5: Learned and Solved Pipeline and Different Types of Projections techniques.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Computer Graphics Lab**
Course Code: 25BCA-403P	**Title: Computer Graphics Lab**

Course Objectives:
CO1: Solve different types of display techniques.
CO2: Apply Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Solve 2DTransformations and Composition of 3-D Transformation.
CO4: Apply Point, Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm
CO5: Solve Pipeline and Different Types of Projections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2(In Hours/Week)
Practical- 2 Hrs.=1Credit (4Hrs./Week=2 Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a Program to draw basic graphics construction like line and Hut.	2
II	Write a Program to draw basic graphics construction like circle and transistor.	2
III	Write a Program to draw basic graphics construction like arc and moving images.	2
IV	Write a Program to draw basic graphics construction like ellipse and different shapes.	2
V	Write a Program to draw basic graphics construction like rectangle and smile face	2

Text Books:
1. D. Hearn & M.P. Baker, "*Computer Graphics*", Pearson Education.
2. Foley, VanDam, Feiner, Hughes, "*Computer Graphics: Principles & Practice*", Addison Wesley Professional.

Reference:
1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press.
2. John Vince, "*Mathematics for Computer Graphics",* Springer.

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25

Total:	**50**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Learned and Solved different types of display techniques.. CO2: Learned and Solved concepts of Point, Line, Circle, Ellipse, Polygon algorithm. CO3: Learned and Solved 2DTransformations and Composition of 3-D Transformation. CO4: Applied Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm CO5: Learned and Solved Pipeline and Different Types of Projections techniques.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: IOT**
Course Code: 25BCA-404-1	**Title: IOT**

Course Objectives:

CO1: To analyze the conceptual framework, architectural components, and technological foundations of IoT and M2M communication systems, enabling students to evaluate their applications and design principles for connected devices.

CO2: Analyze and evaluate various hardware components and embedded platforms used in IoT systems, including sensors, actuators, RFID technology, and wireless sensor networks, to understand their roles and applications in real-world IoT environments.

CO3: Evaluate various wireless medium access and routing protocols used in IoT networks, and analyze strategies for sensor deployment, node discovery, and efficient data aggregation to optimize network performance.

CO4: Enable students to apply foundational programming concepts to configure and operate Arduino boards for real-world IoT applications using the Arduino IDE and relevant libraries.

CO5: Help students understand the key design, development, and security challenges in IoT systems, along with the diverse applications ranging from smart metering to smart city infrastructure.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (3Hrs./Week=3Credits)

Unit	Contents	No. of Lectures Allotted
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability.	8
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Net Arduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	8
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.	8

IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	8
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	8

Text Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", willey.
2. Jeeva Jose, Internet of Things, Khanna Publishing House.
3. Michael Miller "The Internet of Things" by Pearson.
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016.
5. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications, 2014. 6. Adrian McEwen,HakinCassimally "Designing the Internet of Things" Wiley India.

Reference:

1. **"Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti at** Universities Press (2014).
2. **"Internet of Things: Principles and Paradigms" by** Rajkumar Buyya, Amir Vahid Dastjerdi *Publisher:* Morgan Kaufmann.
3. **"Building Internet of Things with the Arduino" by** Charalampos Doukas *Publisher:* Packt Publishing.
4. **"Internet of Things: Architecture and Design Principles" by** Rajkumar Buyya, Satish Narayana Srirama *Publisher:* Wiley (2020)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: By the end of the course, students will be able to design IoT/M2M systems by applying standardized communication technologies and data enrichment strategies to create affordable and efficient

CO2: By the end of the course, students will be able to design and implement basic IoT solutions using embedded platforms such as Arduino and Raspberry Pi, integrating sensors, actuators, and wireless communication modules to solve practical problems.

CO3: Students will be able to compare and select appropriate MAC and routing protocols for specific IoT scenarios, and implement node deployment and data dissemination techniques to enhance communication efficiency within sensor networks.

CO4: By the end of this course, learners will be able to analyze and troubleshoot Arduino-based IoT

systems by interpreting code behavior through emulators and physical board testing. CO5: By the end of the course, students will be able to evaluate IoT application designs—such as smart street lighting or home automation—by identifying potential technical and security challenges and proposing viable solutions.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Computer Based Numerical and Statistical Techniques**
Course Code: 25BCA-404-2	**Title: Computer Based Numerical and Statistical Techniques**

Course Objectives:
CO 1: Students will learn to find roots of algebraic and transcendental equations
CO 2: Student will explore techniques like Newton's forward/backward interpolation
CO 3: learn to approximate derivatives and integrals using numerical methods
CO 4: Students will be introduced to various methods for solving ordinary differential equations
CO 5: Students will gain skills in hypothesis testing and using statistical techniques for analyzing data.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)

Unit	Contents	No. of Lectures Allotted
I	Numbers and their accuracy, Computer Arithmetic, Mathematical preliminaries, Errors and their Computation, General error formula, Error in a series approximation Solution of Algebraic and Transcendental Equation: Bisection Method, Iteration method, Method of false position, Newton-Raphson method, Methods of finding complex roots, Muller's method, Rate of convergence of Iterative methods, Polynomial Equations.	8
II	Finite Differences, Difference tables Polynomial Interpolation: Newton's forward and backward formula Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Interpolation with unequal intervals: Langrange's Interpolation, Newton Divided difference formula, Hermite's Interpolation,	8
III	Numerical Integration and Differentiation: Introduction, Numerical differentiation Numerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Boole's rule, Waddle's rule	8
IV	Solution of differential Equations: Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta Methods, Predictor Corrector Methods, Automatic Error Monitoring and Stability of solution	8
V	Statistical Computation: Frequency chart, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves etc, Data fitting with Cubic splines, Regression Analysis, Linear and Non-linear Regression, Multiple regression, Statistical Quality Control methods.	8

Text Books:

1. T Veerarajan, T Ramachandran, "Theory and Problems in Numerical Methods, TMH

Reference

1. Rajaraman V, "Computer Oriented Numerical Methods", Pearson Education
2. Jain, Iyengar and Jain, "Numerical Methods for Scientific and Engineering Computations", New Age Int.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to find roots of algebraic and transcendental equations.
CO2: Able to solve techniques like Newton's forward/backward interpolation.
CO3: Able to Evaluate approximate derivatives and integrals using numerical methods.
CO4: Able to solve differential equations.
CO5: Understand basic concept of statistics and analyze data.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programmed: Degree **Class: BCA**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Introduction to Machine Learning**
Course Code: 25BCA-404-3	**Title: Introduction to Machine Learning**

Course Objectives:

CO1: Understand the core principles of machine learning, including supervised, unsupervised, and reinforcement learning.
CO2: To gain proficiency in using Python libraries essential for data science, such as NumPy, Pandas, and Matplotlib.
CO3: Learn and implement various regression and classification algorithms.
CO4: Learn master techniques for data preprocessing, feature selection, and model evaluation to build robust ML models.
CO5: Evaluate hands-on experience by applying machine learning algorithms to real-world and standard datasets.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Foundations of Machine Learning : Introduction to Machine Learning (ML), key terminology, and the learning process. Types of ML: Supervised, Unsupervised, Semi-supervised, and Reinforcement Learning. Role of ML in data science and big data. Datasets for ML: sources, types (training, validation, testing), and characteristics. Real-world applications and societal impact.	8
II	Data Science Toolkit in Python • **NumPy:** Introduction to numerical computing, creating and indexing NumPy arrays, data types, and array mathematics (transformations, reshaping, broadcasting). • **Pandas:** Introduction to Series and DataFrames. Data loading, viewing, and selection (loc, iloc). Handling missing data, basic statistical operations, and applying functions.	8
III	Regression and Classification Models • **Regression:** Simple Linear Regression, Ordinary Least Squares (OLS). Introduction to Scikit-learn. Implementing Linear Regression with Scikit-learn on toy datasets. Model Evaluation Metrics: Mean Absolute Error (MAE), Mean Squared Error (MSE), and R-squared (R2) score.	8

	• **Classification:** Introduction to classification problems. Logistic Regression. Model Evaluation Metrics: Accuracy, Confusion Matrix.	
IV	Data Preprocessing and Model Tuning • **Data Scaling:** Standardization (Standard Scaler) and Normalization (Min Max Scaler, l1, l2 norms). • **Handling Missing Data:** Imputation strategies for numerical and categorical data. • **Feature Selection:** Understanding feature importance. Filter methods: Correlation, Chi-squared (X2) test, F-score, and Mutual Information.	8
V	Advanced Supervised Learning Algorithms • **Decision Trees:** Classification and Regression Trees (CART) algorithm. • **Instance-Based Learning:** k-Nearest Neighbors (k-NN) algorithm. • **Support Vector Machines (SVM):** Maximal margin classifier, support vectors, and the use of kernels (linear, polynomial, RBF).	8

Text Books:

1. Géron, A. (2022). *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow* (3rd ed.). O'Reilly Media.
2. Müller, A. C., & Guido, S. (2016). *Introduction to Machine Learning with Python: A Guide for Data Scientists*. O'Reilly Media.

Referential Books

1. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. Springer.
2. Bishop, C. M. (2006). *Pattern Recognition and Machine Learning*. Springer.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Artificial Intelligence

Course Learning Outcomes:

CO1: Able to Explain the fundamental concepts of machine learning and its real-world applications.
CO2: Able to Perform data manipulation, cleaning, and visualization using Python's data science stack.
CO3: Implement and evaluate linear and logistic regression models using Scikit-learn.
CO4: Apply various data pre-processing techniques to prepare data for machine learning models.
CO5: Build and compare different supervised learning models like Decision Trees, SVMs, k-NN, and Ensemble methods.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Introduction to Artificial Intelligence**
Course Code: 25BCA-404-4	**Title: Introduction to Artificial Intelligence**

Course Objectives:

CO1: To understand about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: To study the concepts Propositional logics, predicate Logic.
CO3: To understand the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts.
CO4: To understand concepts of Prolog and Implement the Prolog Program.
CO5: To learning concepts of Expert system and Learning.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.= 1 Credit (4 Hrs./Week= 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).	**8**
II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, No deductive Inference Methods, Rules.	**8**
III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts	**8**
IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/output and Streams, Databases, Implementation of Concepts in Prolog.	**8**
V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition, Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice, Learning	**8**

	in Problem Solving, Learning from Example-Induction, Explanation Based learning.	

Text Books:

1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill.
   Dan W. Patterson, *"Introduction to Artificial Intelligence& Expert Systems"*, PHI.
2. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.

Referential Books:

1. Stuart J. Russell &Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall.
2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: mathematics, statistics, and Computer programming.

Course Learning Outcomes:

CO1: Learnt about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: Learnt study the concepts Propositional logics, predicate Logic
CO3: Learnt the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO4: Learnt concepts of Prolog and Implement the Prolog Program.
CO5: Learnt concepts of Expert system and Learning.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Professional Skills**
Course Code: 25BCA-405	**Title: Professional Skills**

Course Objectives:

CO1: Develop professional skills by understanding personal growth, workplace behavior, and continuous professional development.
CO2: Identify and strengthen professional talents through self-assessment, communication, teamwork, and leadership skills.
CO3: Apply goal-setting techniques and career planning strategies to achieve personal and professional objectives.
CO4: Gain practical workplace exposure by participating in internships and demonstrating professional responsibility.
CO5: Demonstrate ethical behavior, inclusivity, customer orientation, and collaboration to enhance employability skills.

Nature of Paper: AECC-4

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Professional Development: Meaning of professional development, importance of professional skills, types of professional development, lifelong learning, personal branding, work–life balance.	8
II	Identifying Professional Talents: Professional talents and skills, soft skills and hard skills, self-assessment, communication skills, teamwork, leadership, time management, emotional intelligence.	8
III	Goal Setting and Career Planning: Meaning of goals, SMART goals, steps of goal setting, career planning, self-assessment, career options, skill development, professional networking.	8
IV	Internship and Workplace Exposure: Meaning of internship, objectives of internship, types of internships, benefits of internships, employer and intern responsibilities, internship preparation.	8
V	Workplace Ethics and Employability Skills: Professional ethics, equality and equity, gender sensitivity, cultural diversity, customer service, collaboration, administrative skills, marketing and networking skills.	8

Text Books:

1. Covey, Stephen R. *The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change*. Free Press, 1989.
2. Locke, Edwin A., and Gary P. Latham. *A Theory of Goal Setting and Task Performance.* Prentice Hall, 1990.
3. Oldman, Mark, and Samer Hamadeh. *The Internship Bible*. Princeton Review Publishing, 2005.
4. Sharma, Prshant.. *Soft Skills Personality Development for Life Success*. BPB Publications 20, Ansari Road, Darya Ganj, New Delhi-110002, 2019.
5. Subramanian, R. *Professional ethics* (2nd ed.). Oxford University Press India, 2014.

Reference

1. Robbins, Stephen P., and Timothy A. Judge. *Organizational Behavior*. Pearson Education, 2017.
2. Greenhaus, Jeffrey H., Gerard A. Callanan, and Veronica M. Godshalk. *Career Management*. SAGE Publications, 2019.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: **On completion of this module, students will be able to** understand professional development, lifelong learning, and work–life balance.

CO2: **By the end of this module, students will learn to** identify their talents and build essential soft and hard skills.

CO3: **After successful completion, students will be able to** set SMART goals and plan their careers effectively.

CO4: **At the conclusion of this module, students will be able to** understand internships and prepare for workplace exposure.

CO5: **Upon completing this module, students will be able to** apply workplace ethics and key employability skills.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Design and analysis of algorithms**
Course Code: BCA-NEP-501	**Title: Design and analysis of algorithms**

Course Objectives:

CO1. Analyze the asymptotic performance of algorithms.
CO2. Write rigorous correctness proofs for algorithms.
CO3. Apply important algorithmic design paradigms and methods of analysis
CO4. Demonstrate a familiarity with major algorithms and data structures.
CO5. Synthesize efficient algorithms in common engineering design situations

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal+ ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction** Algorithms, Analyzing Algorithms, Complexity of Algorithms, Growth of Functions	8
II	**Algorithm Design Techniques** Divide and Conquer, Greedy Algorithms **Dynamic Programming**: Dijikstra Algorithm, Warshal Algorithm,.	8
III	**Sorting and Searching Techniques:** Elementary sorting techniques–Bubble Sort, Insertion Sort, Merge Sort, Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques, Comparison of Sorting Algorithms	8
IV	**Advanced data structures**: Basic terminology used with Tree, Binary Trees, Red black trees, B- trees	8
V	**Graphs:** Graph Algorithms–Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees. **String Processing: String** Matching, KMP Technique	8

Text Books:

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "*Introduction to Algorithms*", PHI

Reference

1. Sarabasse& A.V. Gelder, "*Computer Algorithm – Introduction to Design and Analysis*", Pearson

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	15 - - 10 75
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1**:** Able to Analyze worst-case running times of algorithms using asymptotic analysis. CO2: Able to describe the divide-and-conquer paradigm. CO3: Able to analyze various searching and sorting algorithms. CO4: Able to implement various sorting techniques. CO5: Able to explain the major graph algorithms and their analyses.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Web Technologies**
Course Code: BCA-NEP-502	**Title: Web Technologies**

Course Objectives:
CO1: Analyze a web page and identify its elements and attributes.
CO2: Create web pages using XHTML and Cascading Style Sheets.
CO3: Build dynamic web pages using JavaScript (Client-side programming).
CO4: Create XML documents and Schemas.
CO5: To develop an ability to design and implement static and dynamic website.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal+ ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Web Page, Website, Web Browser, Internet Address, Uniform Resource Locator (URL), Web Essentials: Clients, Servers, and Communication; Web Servers-Apache, IIS, Proxy Server, HTTP Request Message-Response Message; Web Hosting, TCP/IP Protocol Suite, Installation and Managing Web-Server: IIS/XAMPP/LAMP, Browser Architecture and Web Site Structure	8
II	**HTML:** Basics of HTML, Formatting and Fonts, Commenting Code, Color, Hyperlink, Lists, Tables, Images, Forms, XHTML, Meta Tags, Character Entities, Frames and Frame Sets, Audio and Video.	8
III	**Cascading Style Sheets (CSS):** Need for CSS, Introduction to CSS, Basic Syntax and Structure, Using CSS, Background Images, Colors and Properties, Manipulating Texts, Fonts, Borders and Boxes, Margins, Padding, Lists	8
IV	**XML:** Introduction, Features, XML Document Structure, XML Markups-Element Markup, Attribute Markup, Naming Rules, Components, Comments, Document Type Definitions (DTD)– Internal and External DTD, Developing DTD, Well Formed XML Documents, Valid XML Documents, Validating an XML document using a DTD, XML Schema, Displaying XML Documents, XSL and CSS, XML Namespaces, XML DOM, Extensible Style sheet Language Transformations (XSLT).	8
V	**Java Script-**Introduction, Client-Side JavaScript, Server-Side JavaScript, Data Types, JavaScript Objects, Control Structures, Function, Operators, Statements, Document and Its Associated Objects, Events and Event	8

	Handlers, JavaScript Security.	

Text Books:

1. Aravind Shenoy, "*Thinking in HTML*", Packt Publishing.
2. Suehring "*Java Script Step by Step*",Prentice Hall India Learning Private Limited.
3. Behrouz A. Forouzan, "*Data Communication and Networking*", Tata McGraw Hill.

Reference

1. A.S.Tanenbaum, "*Computer Networks*", Pearson Education Asia.
2. Uttam Kumar Roy, "*Web Technologies",* Oxford University Press.
3. Raj Kamal, "*Internet and Web Technologies",* Tata McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe and differentiate different Web Extensions and Web Services.
CO2: Apply fundamental computer theory to basic programming techniques and fundamental skills to maintain web server services required to host a website.
CO3: Select and apply markup languages for processing, identifying, and presenting of information in web pages.
CO4: Use scripting languages and web services to transfer data and add interactive components to web pages.
CO5: Create and manipulate web media objects using editing software.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Big Data**
Course Code: BCA-NEP-503	**Title: Big Data**
Course Objectives:	
CO1: Demonstrate knowledge of Big Data Analytics concepts and its applications in business. CO2: Demonstrate functions and components of Map Reduce Framework and HDFS. CO3: Develop queries in NoSQL environment CO4: Explain process of developing Map Reduce based distributed processing applications. CO5: Explain process of developing applications using HBASE, Pig etc.	
Nature of Paper: DSE	
Minimum Passing Marks/Credits:40% Marks / 4 Credits (Internal + ESE)	
L: 4 T: 0 P: 0(In Hours/Week) Theory-1Hr.=1Credit	

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	8
II	**Map-Reduce:** Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce.	8
III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop,	8
IV	**Hadoop Eco System and YARN:** Hadoop ecosystem components, schedulers, fairand capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN.	8

	NoSQL Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections	
V	**Hadoop Eco System Frameworks**: Applications on Big Data using Pig, Hive and HBase. **Pig** : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, **HBase** – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, Big Insights and Big Sheets, introduction to Big SQL.	8

Text Book:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
3. Big-Data Black Book, DT Editorial Services, Wiley.

Reference Book:

1. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons
2. Pete Warden, “Big Data Glossary”, O’Reilly

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks /Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the concept of HDFS and map reduce.
CO2: Able to gather large data from a range of data sources.
CO3: Able to understand the hadoop ecosystem components
CO4: Able to explain the architecture of pig and hive with different operations.
CO5: Able to understand the importance and challenges of big data.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Data communication network**
Course Code: BCA-NEP-503	**Title: Data communication network**

Course Objectives:
CO1: To introduce the various types of computer networks.
CO2: To explore the various layers of OSI Model.
CO3: To introduce UDP and TCP Models.
CO4: To identify various application layer protocols.
CO5: To demonstrate the TCP/IP and OSI models

Nature of Paper: DSE

Minimum Passing Marks / Credits: 40% Marks / 4 Credits (Internal+ ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks	8
II	Data link layer: Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, HDLC, Point to Point Protocols. ALOHA, CSMA/CD, LAN – Ethernet IEEE 802.3, IEEE 802.5 – IEEE 802.11, Random access, Controlled access, Channelization.	8
III	Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services,	8
IV	Network layer: Logical Addressing, Internetworking, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.	8
V	Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.	8

Text Books:
1. Data Communications and Networking, Behrouz A. Farozan, Fourth Edition TMH, 2006.
2. Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.

Reference:

1. Data communications and Computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.
3. Computer Networking: A Top-Down Approach Featuring the Internet. James Kurose& Keith W. Ross, 3rd Edition, Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1. Students should understand and explore the basics of Computer Networks and Various Protocols.
CO2. Students will be in a position to administrate a network and flow of information.
CO3. Able to understand the World Wide Web Concepts.
CO4. Able to understand the concepts of network security.
CO5. Able to secure device from network issues.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: ERP**
Course Code: BCA-NEP-503	**Title: ERP**

Course Objectives:

CO1: To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
CO2: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO3: To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
CO4: To develop a process driven thinking towards business processes.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to ERP:** Evolution of ERP; What is ERP? Reasons for the Growth of ERP; Scenario and Justification of ERP in India; Evaluation of ERP; Various Modules of ERP; Advantage of ERP.	8
II	**An Overview of Enterprise:** An Overview of Enterprise; Integrated Management Information; Business Modeling; ERP for Small Business; ERP for Make to Order Companies;. Business Process Mapping for ERP Module Design; Hardware Environment and its Selection for ERP Implementation	8
III	**ERP and Related Technologies:** ERP and Related Technologies; Business Process Reengineering (BPR); Management Information System (MIS); Executive Information System (EIS); Decision support System (DSS); Supply Chain Management (SCM).	8
IV	**ERP Market:** Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Co, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.	8
V	**ERP Implementation Lifecycle:** Issues in Implementing ERP Packages; Pre-evaluation Screening; Package Evaluation; Project Planning Phase; Gap Analysis; Reengineering; Configuration; Implementation; Team Training;	8

	Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).	

Text Books:

1. Daniel E.O' Leary, Enterprise Resource Planning Systems, Cambridge University Press, 2002.
2. Ellen Monk, Bret Wagner, Concepts in Enterprise resource planning, Cengage learning, Third edition, 2009.

Reference

1. Enterprise Resource Planning – Alexis Leon – Second Edition – TMH
2. Manufacturing Resource Planning (MRP II) with Introduction to ERP; SCM; an CRM by Khalid Sheikh, Publisher: Mc Graw-Hill

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: *Problem Solving using C*

Course Learning Outcomes:

CO1: Make basic use of Enterprise software, and its role in integrating business functions
CO2: Analyze the strategic options for ERP identification and adoption.
CO3: Design the ERP implementation strategies.
CO4: Analyze the strategic options for ERP identification and adoption.
CO5: Create reengineered business processes for successful ERP implementation.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA**	**Year: III** **Semester: V**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: DESIGN AND ANALYSIS OF ALGORITHM LAB**
Course Code: BCA-NEP-504P	**Title: DESIGN AND ANALYSIS OF ALGORITHM LAB**

Course Objectives:
CO1: Design algorithms using divide and conquer, greedy and dynamic programming
CO2: Analyze the performance of merge sort and quick sort algorithms using divide and conquer technique.
CO3: Execute sorting algorithms such as sorting, graph related and combinatorial algorithm in a high level language.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal + ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Implement linear searching on a set of elements.	2
II	From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.	2
III	Implement 0/1 Knapsack problem using Dynamic Programming	2
IV	Sort a given set of elements using the Quick sort method	2
V	Implement a Merge Sort algorithm to sort a given set of elements.	2
VI	Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.	2
VII	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.	2
VIII	Implement N Queen's problem using Back Tracking.	2

Reference / Text Books:
1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "*Introduction to Algorithms*", PHI

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	25

5) ESE	25
Total:	**50**

Course Learning Outcomes:

After completing this course, the student will be able to:

CO1: Design an algorithm in a effective manner

CO2: Apply iterative and recursive algorithms.

CO3: Design iterative and recursive algorithm.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA**	**Year: III** **Semester: V**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Web Technologies lab**
Course Code: BCA-NEP-505P	**Title: Web Technologies lab**

Course Objectives:
CO1: Develop static web pages using HTML.
CO2: Design dynamic web pages using Java script and XML.
CO3: Develop Java programs for window/web-based applications.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal+ ESE)

L: 0
T: 0
P: 4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject.	2
II	Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access	2
III	Write programs using Java script for Web Page to display browsers information.	2
IV	Write a Java applet to display the Application Program screen i.e. calculator and other.	2
V	Program to illustrate JDBC connectivity	2
VI	Design and implement a simple shopping cart example with session tracking API.	2
VII	Create a style sheet in CSS/ XSL & display the document in internet explorer.	2
VIII	Create MS Access Database, Create on ODBC link.	2

Reference / Text Books:
1. RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Pankaj Jalote, Software Engineering, Wiley
3. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
4. K.K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report	-
Seminar On Research Project Report	
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Write web-based applications.
CO2: Develop static and dynamic web pages using HTML.
CO3: Design dynamic web page using server site programming.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Cyber Security**
Course Code: BCA-NEP-601	**Title: Cyber Security**

Course Objectives:
CO1: Understand the various tools and methods used in cybercrime.
CO2: Identify risk management processes, risk treatment methods, organization of information security.
CO3: Classify cyber security solutions and information assurance.
CO4: Examine software vulnerabilities and security solutions to reduce the risk of exploitation.
CO5: Analyze the cyber security needs of an organization.

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Ethical Hacking:** Key issues plaguing the information security world, incident management process, and penetration testing, **Foot printing and Reconnaissance:** Various types of footprints, footprints tools, and countermeasures.	10
II	**Scanning Network:** Network scanning techniques and scanning countermeasure.	10
III	**Enumeration & Vulnerability Analysis:** Enumeration techniques and enumeration countermeasure. Vulnerability Analysis using different tools.	10
IV	**System Hacking & Malware Threats:** System Hacking Methodology, Steganography, Steganalysis attacks and covering tracks. Different types of Trojan, Trojan analysis and Trojan countermeasures, working of viruses, Virus analysis, computer worms, malware analysis procedure and communication.	10
V	**Sniffing & Social Engineering:** Packet sniffing techniques, identify theft, and social engineering countermeasure	10

Text Books:

1. K. Kumar," Cyber Laws: Intellectual property & E Commerce, Security", 1st Edition, Dominant Publisher,2011.
2. Rodney D. Ryder, "Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.
3. Information Security policy &implementation Issues, NIIT, PHI.

Reference

1. Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2nd Edition, PHI, 2003.
2. Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, 1st Edition, New Delhi, 2003.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations/Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to analyze and evaluate the cyber security needs of an organization.
CO2: Able to determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
CO3: Able to measure the performance and troubleshoot cyber security systems.
CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
CO5: Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programmed: Degree **Class: BCA**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Artificial Intelligence**
Course Code: BCA-NEP-602	**Title: Artificial Intelligence**

Course Objectives:
CO1: To understand about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: To study the concepts Propositional logics , predicate Logic
CO3: To understand the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO4: To understand concepts of Prolog and Implement the Prolog Program
CO5: To learning concepts of Expert system and Learning.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).	**9**
II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, No deductive Inference Methods, Rules.	**9**
III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts	**9**
IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/output and Streams, Databases, Implementation of All Concepts in Prolog.	**9**
V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition, Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Example-Induction, Explanation Based	**9**

	learning.	

Text Books:

1. Elaine Rich & Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill.
2. Dan W. Patterson, *"Introduction to Artificial Intelligence& Expert Systems"*, PHI.
3. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.

Referential Books

1. Stuart J. Russell &Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall.
2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**
Prerequisites for the course: Artificial Intelligence	

Course Learning Outcomes:

CO1: Learn about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: Learn study the concepts Propositional logics, predicate Logic.
CO3: Learn the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts.
CO4: Learn concepts of Prolog and Implement the Prolog Program.
CO5: Learn concepts of Expert system and Learning.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mobile Computing**
Course Code: BCA-NEP-603	**Title: Mobile Computing**

Course Objectives:
CO1: To understand the basic concepts of mobile computing.
CO2: To learn the basics of mobile data management system .
CO3: To be familiar with the network layer protocols and Ad-Hoc networks.
CO4: To know the basis of transaction and application layer protocols.
CO5: To gain knowledge about different mobile platforms and application development.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Mobile Computing:** Issues in Mobile Computing, Wireless Telephony, Digital Cellular Standards, Bluetooth Technology, Wireless Multiple Access Protocols, Channel Allocation in Cellular Systems. Wireless Application Protocol, WRITE A PROGRAM technology, Mobile Information device, Mobile Computing Applications.	8
II	**Data Management Issues:** Mobility, Wireless Communication and Portability, Data Replication and Replication Schemes, Basic Concept of Multihopping, Adaptive Clustering for Mobile Network, Multi cluster Architecture.	8
III	**Location Management:** Location Based Services, Automatically Locating Mobile Uses, Locating and Organizing Services, Issues and Future Directions, Mobile IP, Comparison of TCP and Wireless.	8
IV	**Transaction Management:** Data Dissemination, Cache Consistency, Mobile Transaction Processing, Mobile Database Research Directions, Security Fault Tolerance for Mobile N/W.	8
V	What is Ad-hoc Network? , Problems with Message Routing in Wireless Ad-hoc Mobile Networks, Routing scheme based on signal strength, Link state and Distance Vector routing protocols, Ad-hoc on Demand Distance Vector.	8

Text Books:

1. Shambhu Upadhyaya, Abhijeet Chaudhary, Kevin Kwiat, Mark Weises, "Mobile Computing", Kluwer Academic Publishers.
2. UWE Hansmann, Lothar Merk, Martin-S-Nickious, Thomas Stohe, "Principles of Mobile

Computing", Springer International Edition.
3. Wireless and Mobile Networks Architectures, by Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001.

Reference

1. Mobile and Personal Communication systems and services, by Raj Pandya, Prentice Hall of India, 2001.
2. Wireless Web Development, Ray Rischpater, Springer Publishing, 2000.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: *Problem Solving using C*

Course Learning Outcomes:

CO1: Understand about mobile communication with their different routing algorithms.
CO2: Apply different data backup schemes used in mobile network to store the data.
CO3: Able to explain about location management that is much important for mobile network.
CO4: Build the knowledge of how transactions are done through mobile, different security issues while mobile transaction.
CO5: Appraise different routing protocols used for routing the path like ADDV, DSR, FSR etc.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: E-Commerce**
Course Code: BCA-NEP-603	**Title: E-Commerce**

Course Objectives:

CO1: Impart the students with knowledge and understanding of contemporary trendsin e-commerce.
CO2: Explain electronic system and Internet.
CO3: Describe the use of e-commerce security.
CO4: To provide adequate knowledge and understanding about E-Com practices to the students.
CO5: Understand the usage of planning and marketing for e-commerce.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**An introduction to electronic commerce**: What is E-Commerce (Introduction and Definition), Main activities E-Commerce. Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, Electronic Commerce and Electronic Business(C2C)(C2G;G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C)	8
II	**The Internet and WWW:** Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.), Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Barter, Exchange, Shopping Bots	8
III	**Internet Security:** Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime (Laws, Types of Crimes), Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus (How it spreads), Virus problem, virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authorization and Authentication, Firewall, Digital Signature.	8
IV	**Electronic Data Exchange:** Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash	8

V	**Planning for Electronic Commerce:** Planning Electronic Commerce initiates, Linking objectives to business strategies, Measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites. **Internet Marketing;** The PROS and CONS of online shopping, The cons of online shopping. Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.	8

Text Books:

1. G.S.V.Murthy, E-Commerce Concepts, Models, Strategies:- Himalaya Publishing House, 2011.
2. Kamlesh K Bajaj and Debjani Nag, E- Commerce, 2005.

Reference

1. Gray P. Schneider, Electronic commerce, International Student Edition, 2011.
2. E-Commerce, Fundamentals and Applications, Wiley Student Edition,

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Identify and explain fundamental web site tools including design tools, programming tools, and data processing tools.
CO2: Apply the solutions on finding major electronic payment issues and options.
CO3: Acquire the knowledge of security issues and explain procedures used to protect against security threats.
CO4: Communicate effectively in ways appropriate to the discipline, audience and purpose.
CO5: Implement the corrective measures to management issues underlying e-Commerce issues including organizational structure, strategic planning, goal setting.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Real Time System**
Course Code: BCA-NEP-603	**Title: Real Time System**

Course Objectives:
CO1: To study the basic of tasks and scheduling.
CO2: To understand programming languages and databases.
CO3: To analyze real time communication.
CO4: To analyze evaluation techniques and reliability models for Hardware Redundancy.
CO5: To understand clock synchronization.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**INTRODUCTION TO TASK SCHEDULING:** Introduction - Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real time Systems, Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms, RM algorithm with different cases.	8
II	**UNI AND MULTI PROCESSOR SCHEDULING:** Uniprocessor scheduling of IRIS tasks, Task assignment, Utilization balancing – Next fit- Bin packing-Myopic off-line - Focused addressing and bidding- Buddy strategy- Fault Tolerant, Scheduling. -Aperiodic scheduling - Spring algorithm.	8
III	**REAL TIME COMMUNICATION:** Introduction – VTCSMA – PB CSMA-Deterministic collision resolution protocol- DCR for multipacket messages- dynamic planning based- Communication with periodic and aperiodic messages.	8
IV	**REAL TIME DATABASES:** Basic Definition, Real time Vs General purpose databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Maintaining Serialization Consistency, Databases for Hard Real Time System.	8
V	**REAL-TIME MODELING AND CASE STUDIES:** Petrinets and applications in real-time modelling, Air traffic controller system – Distributed air defence system.	8

Text Books:

1. Jane W. S. Liu, "Real-time systems", 1st Edition, Prentice Hall, 2000.
2. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wiley & Sons,2004.
3. C. Siva Ram Murthy, G. Manimaran, "Resource management in real-time systems and networks", PHI, 2009.

Reference

1. C.M. Krishna, Kang G. Shin, "Real Time Systems", Tata McGraw - Hil, 2010.
2. Giorgio C. Buttazzo , "Hard real-time computing systems: predictable scheduling algorithms and applications" , Springer, 2008.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Understand the features and structures of practical Operating System implementations.
CO2: Acquire practical knowledge Real Time Operating Systems used in embedded system.
CO3: Understand the use of multitasking techniques in Real Time Systems
CO4: Compare different scheduling algorithms and the schedule ability criteria.
CO5: Analyze real time systems with regard to keeping time and resource restrictions.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA**	**Year: III** **Semester: VI**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Cyber Security Lab**
Course Code: BCA-NEP-605P	**Title: Cyber Security Lab**

Course Objectives:
CO1: Provide practical application of cyber security concepts learned in theory.
CO2: Familiarize students with a wide range of security tools and technologies used in the field.
CO3: Emphasize ethical and legal considerations in the field of cyber security.
CO4: Stay updated with the latest trends, threats, and advancements in cyber security.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L: 0
T: 0
P: 4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=2Credits)

Unit	Contents	No. of Lectures Allotted
I	Checklist for reporting cybercrime at Cybercrime Police Station.	2
II	Checklist for reporting cybercrime online.	2
III	Basic checklist, privacy and security settings for popular social media platforms.	2
IV	Checklist for secure net banking.	2
V	Setting and configuring two factor authentications in the Mobile phone.	2
VI	Installation and configuration of computer Anti-virus.	2
VII	Wi-Fi security management in computer and mobile.	2
VIII	Setting and configuring two factor authentications in the Mobile phone.	2

Reference / Text Books:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.
2. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
3. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
4. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
5. Fundamentals of Network Security by E. Maiwald, Mc Graw Hill.

If the course is available as Generic Elective then the students of following departments may opt it.
1.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to :

CO1: After completion of this module, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2: Students, at the end of this module, should be able to understand the cybercrimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

CO4: After the completion of this module, students would be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

CO5: Students, after completion of this module will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA**	**Year: III** **Semester: VI**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Artificial intelligence lab**
Course Code: BCA-NEP-606P	**Title: Artificial intelligence lab**

Course Objectives:
CO1: Ability to apply standard practices and methodologies in software development and project management.
CO2: Apply various search algorithms of artificial intelligence.
CO3: Understand the concept of Artificial intelligence.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a program in prolog to implement simple facts and Queries	2
II	Write a program in prolog to implement simple arithmetic	2
III	Write a program in prolog to solve Monkey banana problem	2
IV	Write a program in prolog to solve Tower of Hanoi	2
V	Write a program in prolog to solve 8 Puzzle problems	2
VI	Write a program in prolog to solve 4-Queens problem	2
VII	Write a program in prolog to solve Traveling salesman problem.	2
VIII	Write a program in prolog for Water jug problem	2

Reference / Text Books:
1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill.
2. Dan W. Patterson,*"Introduction to Artificial Intelligence& Expert Systems"*, PHI.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: To understand the concept of Artificial intelligence.

CO2: To understand the design principles of pattern recognition with estimation and apply classification technique. CO3: To apply knowledge representation and reasoning techniques.

IIMT UNIVERSITY MEERUT
Transforming Education System, Transforming Lives
UGC Approved Section 2(f) & 12B
NAAC Accredited with A GRADE

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SCHOOL OF COMPUTER SCIENCE & APPLICATIONS

ACADEMIC HAND BOOK



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Ordinance & Academic Regulations
BCA (Cloud and Cyber Security)
(Academic Handbook 2025-26)

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1. PREAMBLE

As the technological enhancement and availability of technology to every person of world a huge demand of computer skilled professional is ample. In this world of opportunities, impact of higher education is so inevitable for getting desired guidance to secure, right kind of employment. It is compulsory to pursue higher related- education in the best institutes. In this direction major reforms are to opt Learning Outcomes-based Curriculum Framework (LOCF), specially, in the undergraduate education (UG) program, that ensure student centric, interactive and outcome-oriented goals, objectives and skill enhancement to acquire. LOCF along with National Education Policy (NEP) in this regard ensure uniform education fabric of standard and content delivery education all over the nation. This syllabus development is a step to ensure development of the undergraduates for both, academia and employability. Latest technical trends, industry standards, market needs, and interests of students, future expectations the need has been taken into consideration while developing the syllabus.

The LOCF inculcation is to build up a comprehensive course structure with detailed syllabus. This is an effort to develop a student centric framework where they are expected to have a concrete understanding of fundamentals of computer science along with the latest trends and techniques like Artificial Intelligence, Internet of Things (IoT), Machine Learning (ML) with advanced skill sets that include Mobile Application environment, Object Oriented Programming (OOPs) among many courses. Each course aims to present learning targets and objectives, and thus provide learning and teaching strategies, assessment and resources. The students shall be equipped with the latest trends in computer science, after completion of the programme

With this an education temple of nation should ensure an environment, which should be bias free, irrespective of cast, religion, races, sex difference and easily available to youths of the nation. The human value, ethics and environmental teaching is also introduced with this.

2. DEFINITIONS AND NO MENCLATURE

In these Regulations, unless the context otherwise requires:

1. "Programme" means Degree Programme like Bachelor of Computer Application (BCA). Hence further BCA and BCA (Cloud and Cyber Security) will call BCA in this document.
2. "GPA" means Grade Point Average.
3. "Course" means a theory or practical subjects that are normally studied in a semester.
4. "VC, Vice-Chancellor of IIMT-University" means the Head of the University.
5. "Registrar" is the Head of all academic and General Administration of the University.
6. "Dean" means the authority of the school that is responsible for all academic activities of various programmes and implementation of relevant rules of these Regulations pertaining to the Academic Programmes.
7. "COE, Controller of Examinations" means the authority of the University who is responsible for all activities relate do the University Examinations, publication of results, award of grade sheets and degrees.
8. "Dean – Student Welfare" is responsible for all student related activities including student discipline, extra and co–curricular activities, attendance and meetings with class representatives, Student Council and parent–teacher meeting.
9. "HoD" means the Head of the Department concerned.
10. "University" means IIMT-University, Meerut.
11. "TCH" means Total Contact Hours–refers to the teaching–learning periods.
12. "DEC" means Department Exam Committee.

13. "BoS" means Board of Studies.
14. "ACM" means Academic Council Meeting the highest authoritative body for approval for all Academic Policies.
15. "Class Coordinator" is a faculty of the class who takes care of the attendance, academic performance, and the general conduct of the students of that class.
16. "IA" is Internal Assessment, which is assessed for every student for every course during the semester.
17. "ESE" is End Semester Examination conducted by the University at the End of the Semester for all the courses of that semester.
18. "UGC" means University Grants Commission.
19. "MHRD" means Ministry of Human Resource Development, Govt. of India.
20. "AICTE" means All India Council of Technical Education.
21. "HEI" means Higher Education Institutions.
22. "PRN" means Permanent Registration Number.
23. "CGPA" means Cumulative GPA.
24. "SGPA" means Semester GPA.
25. "NC" means Non-Credit.

3. VISION AND MISSION OF THE SCHOOL

VISION

To achieve heights in computer education domain by creating appropriate environment for students, faculties and staff with availability of latest technological infrastructure.

MISSION

1. To dissipate appropriate all types of practical and theoretical computer science knowledge to our young students.
2. Inculcate professional efficiency in the students for brighter career opportunity as per industry latest requirement.
3. To provide learning environment for students with our reputed academics partner in the field of computer science.
4. To prepare our student as an IT professional with full of ethics and human values.

4. PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: The graduates' programs are designed to produce skill graduates who will be competent professionals in academics, industry and organizations of government and private sector.

PEO2: The pass out graduates will be able to handle the fast-changing world requirements and will become effective professionals.

PEO3: The successful Graduates will be a good team leader and will be able to lead the team to find optimal solutions and achieve expertise in their field or become entrepreneurs and play the leading roles in all types of organizations.

5. PROGRAM OUTCOMES (PO'S)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

6. PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1: The graduates are proficient in fundamental principles and methods of Computer Science, Mathematical and Scientific reasoning and are able to:

- Apply fundamental concepts of integration, differentiation, vector calculus, probability & statistics, and discrete mathematics.
- Design, create & evaluate algorithms appropriate to specific problems.

PSO2: The graduates have understanding for:

- Demonstrate capability for computers, computer network and server environments and there troubleshooting.
- Capacity to handle cloud computing environment and solutions.
- Well defined knowledge for solving problems of security and threats in information knowledge domain.

7. ADMISSION

Hence further BCA and BCA (Cloud and Cyber Security) will be called BCA in this document. The admission policy and procedure shall be decided from time to time by the University based on the guidelines issued by the UGC/ Ministry of Education, Government of

India. Seats are also made available for Non-Resident Indians and foreign nationals, who satisfy the admission eligibility norms of the University as per the UGC Norms.

8. ELIGIBILITYIN ALL YEARS AS PER NEP (ENTRY)

8.1 Candidate should have passed "10+2" exam (recognized board) in any stream with at least 40% in aggregate.

8.2 Admission will be based on academic record.

8.3 The Academic Council shall have power to amend or repeal the eligibility criteria laid down at clause 8.1& 8.2, if required.

9. CURRICULUM

The curriculum for Bachelor of Computer Application Programme is designed to have minimum and maximum credits as per the scheme of 120-160 credits that are distributed across six semesters of study for the award of degree.

10. MEDIUM OF INSTRUCTION

The medium of instruction is ENGLISH for all courses, examinations, seminar presentations and project reports.

11. CHOICE BASED CREDIT SYSTEM (CBCS)/ LOCF/ OBE

11.1 The three-year curriculum has been divided into six semesters. Semester Ist to VIth shall include lectures, tutorials, practical, seminars and project work as defined in the scheme of instruction and examination issued by the University from time to time.

11.2 The curriculum will be also including such other curricular, co-curricular and extra- curricular activities as may be prescribed by the University from time to time. Credit System BCA programme will have a curriculum in which every course will be assigned certain credits reflecting its weight and contact periods per week, as given below:

1 Lecture period (L) per week = 1 Credit
1 Tutorial period (T) per week = 1 Credit
1 Practical period (P) per week = 0.5 Credit

In addition to theory and laboratory courses there may be other courses such as seminar, project etc., which will be assigned credits as per their contribution in the programme without regard to contact periods.

11.3 Minimum Credit Requirements

The minimum credit required for award of a BCA degree is 120**.** This is normally divided into theory courses, tutorials, laboratory courses, seminars and projects in duration of six semesters. The credits are distributed semester wise as shown in the structure and syllabus manual of the programme. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester wise schedule of courses given in the syllabus manual of the programme.

11.4 Course Categories

Under CBCS, the degree programme will consist of the following categories of courses as per following table:

Table 11.4 - Distribution of Credits (Evaluation Scheme)

S. No.	Category	
1.	Core Course (Theory)-CC	**As per Format 1 & 2 of CBCS**
2.	Core Course (Practical)-CC(P)	
3.	Discipline Specific Elective (Theory)- DSE	
4.	Generic Elective (Theory)-GE	
5.	Ability Enhancement Compulsory Courses-AECC	
6.	Skill Enhancement Courses-SEC	
7.	Research Project (RP)	

11.5 Curriculum Structure

The curriculum for BCA will contain a listing of all courses, with each course having a course category, course number, course title, number of contact periods per week, number of credits assigned, and the marks assigned to various components of evaluation.

11.6 Approval of the Curriculum

The curriculum for BCA programme will be prepared by the department concerned and will be approved by the Board of Studies of the department. The Academic Council for final approval and then the curriculum will be implemented. Same procedure shall be used for any modification in the curriculum.

12. REGISTRATION FOR A COURSE IN A SEMESTER

A student will be eligible for registration of courses only if he/she satisfies the regulation (progression), and has cleared all dues to the University, Hostel and Library up to the end of the previous semester if student is not debarred from enrolment on disciplinary grounds.

The university follows a flexible Choice Based Credit System and slot-based table. Accordingly, the students shall be given the option for selecting their courses, credits, teachers, slots and create their timetable. The student is given the option of selecting the number of credits to undergo in a semester, subject to the curriculum requirements.

Except for the first-year courses, registration for a semester will be done during a specified week before the start of the semester as per the academic calendar.

Late registration /enrolment will be permitted by the Dean of the School for genuine cases, on recommendation by the Head of the respective department, with a late fee as decided from time to time.

The student shall make the choice of course in consultation with the Class Coordinator and as stipulated from time to time.

Students shall have to pay additional fee as prescribed, for registering in certain elective courses under Generic Electives courses offered by certain specific departments and for higher level Foreign Languages, as decided from time to time.

13. ATTENDENCE

The faculty handling a course must finalize the attendance, three calendar days before the last

instructional day of the course and submit to the HoD through the class teacher.

13.1 Condonation of Medical Cases

a. A student with less than 75% attendance (Total Contact Hours -"TCH") in any course, will not be permitted to appear for the end-semester examination in that course, irrespective of the reason for the shortfall of the attendance. The student is however permitted to avail Academic Leave up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD. After the event, the student should submit the relevant documents for proof to the HoD for approval of the Academic Leave.

b. The remaining 25% allowance in attendance is given to account for activities under NCC / NSS / Cultural / Sports/ Minor Medical exigencies etc.

c. Students under "CO (Carry Over)" category in any course shall attend, the immediately following Summer / Winter course. The detailed schedule of the Summer / Winter courses offered in every semester will be announced during the end of that semester. The students who have obtained "CO (Carry Over)" has to select their appropriate slots and courses, optimally to attend the courses.

13.2 Additional Condonation

Additional Condonation may be considered in rare and genuine cases which includes, approved leave for attending select NCC / Sports Camps, cases requiring prolonged medical treatment and critical illness involving hospitalization. For such select NCC / Sports Camps prior permission for leave shall be obtained by the respective Dean / Director of sports from the designated authority, before deputing the students.

For medical cases, submission of complete medical history and records with prior information from the parent / guardian to Dean (Students Welfare) DSW is mandatory. The assessment of such cases will be done by the attendance sub – committee on the merit of the case and put-up recommendations to the Vice – Chancellor. Such condonation is permitted only twice for a student in the entire duration of the programme.

The Vice-Chancellor, based on the recommendation of the attendance sub-committee may then give condonation of attendance, only if the Vice-Chancellor deems it fit and deserving. But in any case, the condonation cannot exceed 10%.

14. ASSESSMENT PROCEDURE

14.1 Internal Assessment (IA) – 25 Marks & External Assessment (EA) - 75 Marks

14.2 Practical Assessment (as per format 1 and 2)

15. RESEARCH PROJECT/SEMESTER PROJECT – ASSESSMENT CRITERIA

The general guidelines for assessment of Project are given in Table 15.1

Table15.1: Assessment pattern for Research Project / Semester Project

S. No.	Review / Examination Scheme	Broad Guidelines	Weightage
1	First Review	Concept	10%
2	Second Review	Design	10%

3	Third Review	Experiment/Analysis	20%
4	Final Review/ESM	Project report and Viva – Voce, Results and Conclusion	60%

16. INTERNSHIP–RESEARCH/INDUTRIAL INTERNSHIP

A student has to compulsorily attend summer internship at the end of 4th semester for a minimum period of 30 days. In lieu of Summer-Winter internship, the student is permitted to register for undertaking project work under a faculty of the University and carry out the project for minimum period of 30 days. In both the cases, the internship report in the prescribed format duly certified by the faculty in-charge shall be submitted to the HOD. The evaluation will be done through presentation and viva. The course will have a weight age as defined in the respective curriculum.

For the final year project and viva-voce end semester examination, the student shall submit a project report in the prescribed format issued by the University. The reviews will be conducted by a committee constituted by the HOD. The end semester assessment will be based on the project report and a viva on the project conducted by a committee constituted by controller of examination. This may include an external expert.

17. FOR NON-CGPA COURSES/AUDIT COURSES

The Assessment will be done based on the respective assessment as per rubrics issued by the HOD.

A student securing less than the minimum specified internal assessment marks in any course will not be permitted to appear for the end-semester examination in that course and will be graded under "CO (Carry Over)" category for that course. This will be denoted in the grade sheet as "CO (Carry Over)", till the course is successfully completed in the subsequent semester(s).

18. CREDIT WEIGHTAGE

Credits are the weightage, assigned to the courses based on the following general pattern:

One Hour	1 credits
Two Hour Practical	0.5 credits

19. MAXIMUM DURATION OF THE PROGRAMME/ PROMOTION POLICY

A student may complete the programme at a slower pace than the regular pace, but in any case, in not more than **N+2 years**.

A student completing the degree programmes in the extended period will not be eligible for university ranking.

20. MAXIMUM GAPS BETWEEN SEMESTER/YEAR

A student may be permitted by the Vice-Chancellor to withdraw from the entire programme for a maximum of two semesters for reasons of ill health, start – up venture or other valid reasons asrecommendedbyacommitteeconsistingofHeadofDepartment,DeanofSchool,andDean(Student Welfare).

21. CREDIT SYSTEM & GRADING CGPA/SGPA

Introduction

IIMT University implemented the UGC guidelines to implement of the choice-based credit system with a view to offer student's choice of courses within a programme with a flexibility to complete the programme by earning credits at a pace decided by the students themselves.

The system allowed students to choose inter-disciplinary, intra-disciplinary courses according to their learning needs, interest and aptitude. It was considered as a cafeteria approach and was expected to provide mobility to students.

21.1 Credit System

As per the current credit system practiced in institutions needs comprehensive reforms as they offer very little flexibility, choice and are less learner centric. Degrees offered today are more self-contained focusing on a specialization area and depend a lot on knowledge available with the faculty from the department only. Though the most requisite credit system does exist, wherein students are given a wide choice and flexibility, these exist as small islands in the vast ocean of thousands of educational institutes in India. In such institutions, the curriculum is frequently designed which is learner centric and offering a wide specialization area for students to pick and choose courses from.

The institutions shall make attempts wherein the design of the credit system and the teaching and evaluation modes shall be the responsibility of individual course teachers. The students should have the freedom to opt for courses from other specializations and not just from their core specialization. For this there has to be stronger collaborations between departments of the University and outside.

21.2 Grading system

Most institutions follow the absolute grading system which is a simple procedure wherein the marks obtained by students correspond to a specific grade and grade point. It reflects the individual performance in a particular subject without any reference to the group/class. The absolute grading system has limitations and may be susceptible to some inconsistencies.

The relative grading system on the other hand provides relative performance of a student to a group/class wherein the student is ranked in a group/class on basis of relative level of achievement. In this system decisions are made in advance by the faculty members as to what proportion of students would be awarded a particular grade on the basis of their relative performance and which is done by assigning grades on basis of a normal curve. This facilitates comparative performance and eliminates negative effect of pass or fail.

Relative grading system may be used if the number of students registered for the course is at least 30. For a class of smaller size, an absolute grading scheme may be used. The statistical method may be used with adjustments to calculate the mean (M), median (Md) and standard deviation (SD) of the total marks (TM) obtained by the students registered for the course. If the mean and median coincide, the mean may be used for further computations, otherwise the median may be used. If suppose the mean is used, then the letter grades may be awarded based on the ranges specified in table below:

A grading system as shown in given table-

Table 21.2: Grading system

Letter Grade	Range
A+	TM>M+1.75SD
A	M+1.25 SD ≤TM<M+1.75SD
B+	M+0.75 SD ≤TM<M+1.25SD
B	M+0.25 SD ≤ TM < M+0.75 SD
C+	M-0.25 SD ≤ TM < M-0.25 SD
C	M-0.75 SD ≤ TM < M-0.25 SD

D+	M-1.25 SD ≤ TM < M-0.75 SD
D	M-1.75 SD ≤ TM < M-1.25 SD
E+	M-2.0 SD ≤ TM < M-1.75 SD
E	M-2.25 SD ≤ TM < M-2.0 SD
F	M-2.25 SD > TM
CO	Carry Over (Summer / Winter) due to Attendance deficiency (between 40% and 75%)and/or I. Lack of minimum IA marks as specified in clause 10.0 Table 3.
RA	Repeat the course due to (i) Lack of minimum attendance (below 40%) in regular course.
--	DETAINED "RC" or "RA" or both in all registered theory courses of a semester. The student is detained and has to repeat the entire semester. Clause 12.3

Letter grades may be improved based on the following scheme: Use the table above to determine grade boundaries. Look for natural gaps in the neighborhood of grade boundaries. Choose the largest gap in the neighborhood and make this as the grade boundary.
An 'E', 'E+' and 'F' grade may not be a purely relative grade. These may be assigned on the following basis:

- A minimum, say 30/100, may be set as pass marks for the course. A fail grade may then be awarded only if the Total Marks for the course are less than 30. Otherwise, the students may be awarded the Just Pass Grade D.
- A fail grade may be awarded to students whose marks are below the prescribed minimum even if the table above leads to a pass grade.
  Similarly, a lower limit may be set for the A grade also, for instance greater than or equal to 86. Students not achieving the prescribed minimum may be awarded a lower letter grade even if the table above indicates otherwise. A pass grade may be made mandatory for both internal as well as external examinations in the case of a separate internal and external assessment,

a. Internal and External marks may be summed up with appropriate weightage to compute a total out of 100 marks. The letter grade may be assigned on this computed total.
b. Internal and external marks may be graded separately and then the assigned grade points may be used, with appropriate weightage, to compute a final grade point and letter grade.

Grading in the case of Re-evaluations, Retests and Remedial Examinations may be based on the following guidelines:

a. The ranges of marks once computed for awarding letter grades the first time, called the First Distribution (FD), will not be modified.
b. If a re-evaluation leads to a change in marks, then FD will be used to award an appropriate letter grade.
c. A retest may be permitted, if
   i. A student gets a letter grade of E+ or E. In this case, irrespective of the marks obtained, at most D grade may be awarded.
   ii. A student is unable to complete course requirements because of certified illness or tragedy. In this case FD will be used to award an appropriate letter grade.

The use of relative grading system may be recommended in autonomous institutions, institutes of national importance and institutions with high ranking. The results of the relative grading system may be shared by such institutions later with other interested institutions to implement the same.

21.3 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i "and the grade points Pi earned for that course taken over all courses "i" registered and successfully completed by the student to the sum of Ci for all "i". That is,

$$GPA = \frac{\sum_i C_i P_i}{\sum_i C_i}$$

CGPA will be calculated in a similar manner, in any semester, considering all the courses enrolled from the first semester onwards.

21.2 The Grade card will not include the computation of GPA and CGPA for courses with letter grade CO, RC and U until those grades are converted to the regular grades.

21.3 A course successfully completed cannot be repeated.

Grade Sheet

Letter grade

Based on the performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and corresponding grade points are given in Table 8.
A student is considered to have completed a course successfully and earned credits if he/she secures a letter grade other than F, CO, RA in that course.
After results are declared, grade sheet will be issued to each student which will contain the following details:

a. Program and discipline for which the student has enrolled.
b. Semester of registration.
c. The course code, name of the course, category of course and the credits for each course registered in that semester
d. The letter grade obtained in each course
e. Semester Grade Point Average (GPA)
f. The total number of credits earned by the student up to the end of that semester in each of the course categories.
g. The Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.
h. Credits earned under Non CGPA courses.

22. CLAS/DIVISION

22.1 Classification is based on CGPA and is as follows:

CGPA ≥ 8.0 : **First Class with distinction**
6.5 ≤ CGPA <8.0 : **First Class**
5.0 ≤ CGPA <6.5 : **Second Class**

22.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance with effect from II semester, within the minimum duration of the programme.

(ii) The award of 'First Class is further subject to the candidate becoming eligible for the

award of the degree having passed the examination in all the courses within 3 years for Bachelor of Computer Application.

(iii) The period of authorized break of the programme (vide clause 11.0) will not be counted for the purpose of the above classification.

23. TRANFER OF CREDITS/ACADEMIC CREDIT BANK

23.1 "Credit-transfer" means the mechanism by which the eligible HEIs registered with ABC are able to receive or provide prescribed 'credits' to individual registered ABC account in adherence to the UGC credit norms for the 'course/s' registered by the desirous students in any eligible higher education institution within India

23.2 Within the broad framework of these regulations, the Academic Council, based on the recommendation of the Credit Transfer Committee so constituted may permit students to transfer part of the credit earned in other approved Universities of repute & status in the India or abroad.

23.3 The Academic Council may also approve admission of students who have completed a portion of course work in another approved Institute of repute under Multiple entry & Exit system, based on the recommendation of the credit transfer committee on a case-to-case basis.

23.4 Students who have completed coursework, at least first year, at some university other than the university to which transfer is to be sought, may request for transfer of admission to this university. A student may be granted admission only through an admission process that will follow the same policy as for fresh admissions. However, a uniform credit system must be followed by all universities to effect transfer of credits.

23.5 Credit Transfer request can be submitted only after the student has been admitted in the concerned program and the following conditions are met:
University Grants Commission initiated the concept of National Academic Credit Bank (NAC-Bank) which will be a digital / virtual / online entity to be established and managed by UGC. The main objective of the NAC-Bank would be to facilitate student mobility across the education system wherein the credits can be accumulated and be used at alter point of time for the requirements of partial fulfillment of a degree program.

i. The course work has been completed at a UGC approved and accredited University through fulltime formal learning mode.
ii. The university accreditation grade/ ranking is not lower than that of the university to which the transfer is sought.
iii. The courses prescribe to the common minimum syllabus under UGC CBCS system.
iv. The letter grade obtained in the courses is "B" or better.
v. The number of credits to be transferred does not exceed the prescribed limit.
vi. The program in question must have a similar credit system, in particular, modular or semester and the same numeric and letter grading system along with common meaning of the term "credit" in numerical terms.

The aspect of shelf life of courses needs to be considered while accepting credits as obsolescence of knowledge of certain field in terms of its current relevance needs to be investigated. The time elapsed between successful completion of certain courses of the program and the admission to which program transfer is sought needs to be considered. The

maximum number of credit points that may be considered under a credit transfer needs to be specified. Contextual variables such as teaching-learning approach adopted, learning facilities offered, use of evaluation modes may also be considered while preparing the credit transfer policy.

Moderation

Moderation of assessment is an organized procedure which ensures use of valid assessment material and consistent application of criteria, to provide fair academic judgment and reliable outcome in the form of marks or grades. It assures appropriate designing and implementation of assessment activities along with generation of valid and reliable results.

Integration of moderation process with assessment system is imperative for the development of academic quality in higher educational institutions as:

- It addresses any difference in individual judgments of different evaluators.
- It ensures that all achievements in the form of marks and grades across courses reflect achievement of same level of standard.
- It is also carried out to develop a common understanding of the standards and criteria and to recognize performance which demonstrates that standard or fulfils those criteria.

Moderation may be conducted in case there are large number of fail grades or high grades, or when large numbers of students who have received the same grade or clustering of students on letter grades, or when there are discrepancies between grades allocated to individual students in different courses, or to find out the difficulty level of the question paper or whether the assessments modes used cover the entire syllabus or not.

Applicability

Moderation will be made applicable to both external and internal modes of assessment. All programs and courses will indicate, as part of their statements on assessment, arrangements for the moderation of assessed work. This can be done through formulation of a moderation policy and implemented across all programs and courses of instruction and delivery. The time frame for the moderation will be linked with the time frame for assessment.

In the event moderation is triggered, an evaluation will begin with a discussion on the following (though not exhaustive) lines:

a. What are the rubrics used for each of the different types of assessment in the course? Is a standardized/ prescribed rubric used or has the instructor developed his/ her own rubric. If the instructor is using a personally framed rubric, or if there is no identified rubric, then how does the assessment map to learning outcomes?

b. The difficulty level of the questions included in the assessments, i.e., is the difficulty level on the extremes, very easy or very hard.

c. The manner of awarding marks, i.e., has the correction been at the extremes, liberal or tough.

Each department will establish a committee and designate roles and responsibilities at different levels for smooth working of the moderation process. In order to maintain neutrality, it will be ensured that moderator should not be the assessor. Staff members will be trained professionally in assessment techniques and moderation procedures. All assessment material produced by learner including examination sheets, assignments, project reports, research reports etc. will be examined.

Institutions will be encouraged to make the moderation process online. In this system, assessment plans, moderation plans, assessment tools, samples of which may be submitted online. Moderation reports will be generated online so that progress can be tracked and submitted to the COE after the approval of Dean and HOD. The moderation will not be restricted to just assessment but also include moderation of content and assessment design.

24. CHANGE OF DISCIPILINE

"Academic Flexibility" is the provision for innovative and interchangeable curricular structures to enable creative combinations of Courses/Programmes in Disciplines of study leading to Degree/Diploma/PG Diploma/Certificate of Study offering multiple entry and multiple exit facilities in tune with National Education Policy-2020, while removing the rigid curricular boundaries and creating new possibilities of life-long learning.

25. USE OF TECNOLOGICAL INTERVENTIONS

With the proliferation of different types of access devices, especially mobile access devices, technology has the potential to augment traditional classroom practices and revolutionize learning and evaluation methods. Technology, in fact can be an important driver to enable lifelong learning. Learning and engagement of students is facilitated by use of technology through several modes such as synchronous learning, semi-synchronous learning, blended learning, collaborative learning, flipped classroom etc. MOOC's, especially provided through SWAYAM, are a window of opportunity for lifelong learning and are offered through technology-based platforms. Learning management systems (LMS) may be used by institutions to integrate the entire teaching, learning and evaluation process. The Learning Management System may be used by institutions to deliver academic content in blended form and to assess learning through thesis, assignments etc. Open-source learning management systems such as *Moodle, Edmodo* may be used for posting content in the form of videos, audios, e-learning modules, live class sessions etc. Use of plagiarism detection software will be highly recommended to check originality of the content.

In the conduct of examinations, universities face tremendous challenges such as need for trained manpower, distribution of question paper without delays and errors, delays in evaluation of answer scripts, lack of infrastructure to conduct examinations at a large scale, non-availability of faculty members for assessment, security issues faced during paper setting and paper distribution, tampering of certificates and answer scripts etc.

For a typical examination department of an institution will be an autonomous body right from registration of student to convocation through an integrated system. In fact, steps must be taken to implement a complete examination management system that considers the complete life cycle of examination process. The use of technology will reduce dependency on human intervention and be error free. The following functions will be automated:

i. Registration of students and generating unique PRN,
ii. Filling up of examination form,
iii. Generation of seat numbers and admit cards/hall tickets,
iv. Preparation of list of paper setter,
v. Use of question bank system to draw question sets, question paper generation,
vi. Online distribution of question papers on the day of examination with system of encryption,
vii. Barcode system for answer books (this will eliminate issues related to errors, avoid malpractices etc.),
viii. Digitization of answer scripts and onscreen evaluation of answer sheets,
ix. Tracking of student's performance,
x. Marks submission through online software,
xi. Viewing of result through online system,
xii. Online verification and revaluation system,
xiii. Digitization of certificates and marksheets (to avoid tampering and easy retrieval),

xiv. Certificate authentication system,
xv. Submission of various other applications through online system.

The above will lead to conduct of functions of the examination system in an efficient and transparent manner and timely availability of information to students.

26. STUDENT DESCIPILINE

Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige reputation of the University and School.

27. STUDENT WELFARE

Any act of indiscipline of a student reported to the Dean (Students Welfare) and Head of the Department will be referred to a Discipline Committee constituted for the purpose. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also authorize the Dean (Students Welfare) to recommend to the Vice-Chancellor for the implementation of the decision. The student concerned may appeal to the Vice-Chancellor, whose decision will be the final.

28. RAGGING

Ragging in any form is a criminal and non-bail able offence in our country. The current State and Central legislations provide stringent punishments including imprisonment. Once the involvement of a student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the University, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student at the University, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

29. POWER TO MODIFY

Not with standing all that has been stated above, the Academic Council is vested with powers to modify any or all the above regulations from time to time, if required, subject to the approval by the Board of Studies and final approval by Vice-Chancellor.

30. EXIT POINT

Exit point will be governed as per format 1 and format 2.

31. NC/CREDIT COURSE

For non-credit courses ‘Satisfactory’ or ‘Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Evaluation Scheme

BCA (CLOUD COMPUTING AND CYBER SECURITY)

BCA (CLOUD COMPUTING AND CYBER SECURITY) Year: I / Semester: I											
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	25BCACCS-101	Problem solving techniques using 'C' Language	C1	3	0	0	25	75	**100**	**3**
2	24BCACCS-102	Mathematics for Computing-I	C2	4	0	0	25	75	**100**	**4**
3	25BCACCS-103	Introduction to Cloud using AWS	C3	3	0	0	25	75	**100**	**3**
4	24BCACCS-104-1 24BCACCS-104-2 24BCACCS-104-3 24BCACCS-104-4	**Select Any One** 1.ERP 2.M-Commerce 3. Feature Engineering 4. Basics of Data Analytics using Spreadsheets.	DSE 1	4	0	0	25	75	**100**	**4**
5	24BCACCS-105	Computer Basics and Office Automation Tools	SEC 1	2	0	0	25	75	**100**	**2**
6	25BCACCS-106P	Problem solving techniques using 'C' Language Lab	C1 Lab	0	0	2	25	25	**50**	**1**
7	25BCACCS- 107P	Introduction to Cloud Lab using **AWS**	C3 Lab	0	0	2	25	25	**50**	**1**
8	24BCACCS-108P	Computer Basics and Office Automation Tools Lab	SEC 1	0	0	2	25	25	**50**	**1**
9	NHU-111	English Communication	AECC 1	3	0	0	25	75	**100**	**3**
10	IEMM-402	Indian Ethos and Modern Management	VAC 1	2	0	0	25	75	**100**	**2**
11	SPT-PC-111	SPORTS		0	0	2	15	35	**50**	**NC**
		Grand Total		**21**	**0**	**8**	**265**	**635**	**900**	**24**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course											

BCA (CLOUD COMPUTING AND CYBER SECURITY) Year: I / Semester: II											
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	24BCACCS-201	Advance 'C' Programming	C4	3	0	0	25	75	100	3
2	24BCACCS-202	Mathematics for Computing-II	C5	4	0	0	25	75	100	4
3	24BCACCS-203	Linux Administration with Scripting	C6	3	0	0	25	75	100	3
4	24BCACCS-204-1 24BCACCS-204-2 24BCACCS-204-3 24BCACCS-204-4	Select Any One 1. Digital Marketing 3. Artificial Intelligence 2. Information System 4. Cloud Computing.	DSE 2	4	0	0	25	75	100	4
5	24BCACCS-205	IPR/E&I will be run by NPTEL, registration will start in January of every year.	SEC2	0	0	4	0	0	0	2
6	24BCACCS-206P	Advance 'C' Programming Lab	C4 Lab	0	0	2	25	25	50	1
7	24BCACCS-207P	Linux Administration with Scripting Lab	C6 Lab	0	0	2	25	25	50	1
8	NHU-NPR-112	Environment and Ecology	AECC2	4	0	0	25	75	100	4
9	NHU-NPR-112P	Environment and Ecology Lab	AECC2 Lab	0	0	2	25	25	50	1
10	Course code will be provided by School from with Generic elective	Generic Elective (To be opted from other school of IIMTU)	GE 1	4	0	0	25	75	100	4
11	SPT-PC-211	SPORTS		0	0	2	15	35	50	1
		Grand Total		**22**	**0**	**12**	**240**	**560**	**800**	**28**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course										

BCA (CLOUD COMPUTING AND CYBER SECURITY) Year: II / Semester: III											
S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme							
				Periods			Internal Marks	External Marks	Total Marks	Credits	
				L	T	P					
1	25BCACCS-301	Data Structure and Algorithms using 'C'	C7	3	0	0	25	75	100	3	
2	25BCACCS-302	Operating Systems	C8	3	0	0	25	75	100	3	
3	25BCACCS-303	Advance Cloud Security-I	C9	3	0	0	25	75	100	3	
4	25BCACCS-304-1 25BCACCS-304-2	**Select Any One** 1. Block Chain Technology 2. Data Mining and Data Warehousing	DSE-3	4	0	0	25	75	100	4	
5	UVE-401	Universal Human values & Professional Ethics	AECC-3	3	0	0	25	75	100	3	
6	25BCACCS-305	Basics of SQL	SEC-3	2	0	0	25	75	100	2	
7	25BCACCS-306	Cyber Security	VAC-2	3	0	0	25	75	100	3	
8	25BCACCS-301P	Data Structure and Algorithms using 'C' Lab	C7 Lab	0	0	2	25	25	50	1	
9	25BCACCS-302P	Operating System Lab	C8 Lab	0	0	2	25	25	50	1	
10	25BCACCS-303P	Advance Cloud Security-I Lab	C9 Lab	0	0	2	25	25	50	1	
11	25BCACCS-305P	Basics of SQL Lab	SEC-3	0	0	2	25	25	50	1	
12	Course Code to be given by the School of IIMTU whose Generic Elective will run	Course name to be given by the School of IIMTU whose Generic Elective will be chosen.	GE-2	4	0	0	0	0	0	4	
13	SPT-PC-311	Sports		0	0	2	15	35	50	NC	
		Grand Total		25	0	10	290	660	950	29	

C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course

BCA (CLOUD COMPUTING AND CYBER SECURITY) Year: II / Semester: IV											
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**							
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**	
				L	**T**	**P**					
1	25BCACCS-401	OOPs using Java	C10	3	0	0	25	75	**100**	**3**	
2	25BCACCS-402	Software Engineering	C11	3	0	0	25	75	**100**	**3**	
3	25BCACCS-403	Advance Cloud Security-II	C12	3	0	0	25	75	**100**	**3**	
4	25BCACCS-404-1 25BCACCS-404-2	**Select Any One** 1. IOT 2.Computer Based Numerical and Statistical Techniques	DSE 4	4	0	0	25	75	**100**	**4**	
5	25BCACCS-405	Professional Skills	AECC4	3	0	0	25	75	**100**	**3**	
6	25BCACCS-406	E&I/IPR through NPTEL.	SEC4	0	0	4	0	0	**0**	**2**	
7	Course code to be provided from IIMTU other Schools	Generic Elective (To be opted from other Schools of IIMTU)	GE 3	4	0	0	25	75	**100**	**4**	
8	25BCACCS-401P	OOPs using Java Lab	C10 Lab	0	0	2	25	25	**50**	**1**	
9	25BCACCS-402P	Software Engineering	C11 Lab	0	0	2	25	25	**50**	**1**	
10	25BCACCS-403P	Advance Cloud Security-II Lab	C12 Lab	0	0	2	25	25	**50**	**1**	
11	SPT-PC-411	Sports		0	0	2	15	35	**50**	**1**	
		Grand Total		**20**	**0**	**12**	**240**	**560**	**800**	**26**	
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course IPR : Intellectual Property Rights , E&I : Entrepreneurship and Innovation L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course											

BCA (CLOUD COMPUTING AND CYBER SECURITY)
Year: III / Semester: V

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	BCA-NEP-511	SPT-V Advance Cyber & Computer Forensic	C1	4	0	0	25	75	100	4
2	BCA-NEP-513	SPT-VI WEB TECHNOLOGY	C2	4	0	0	25	75	100	4
3	BCA-NEP-503	1. Data Communication Network 2. ERP 3. Big Data	DSE	4	0	0	25	75	100	4
4	RP-I AUDIT	Research Project-I@	AUDIT	0	0	0	50	0	50	NC
5	BCA-NEP-IP-I	Internship	Industrial Internship (Mandatory)	0	0	10	50	0	50	5
6	BCA-NEP-512P	SPT-V Advance Cyber & Computer Forensic Lab	CORE LAB 1	0	0	4	25	25	50	2
7	BCA-NEP-514P	SPT-VI WEB TECHNOLOGY Lab	CORE LAB 2	0	0	4	25	25	50	2
		Grand Total		**12**	**0**	**18**	**225**	**275**	**500**	**21**

C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course

NOTE: @RESEARCH PROJECT – I is a Noncredit courses (Audit Courses) and Student needs to qualify it but the marks will not be added in total marks

BCA (CLOUD COMPUTING AND CYBER SECURITY) Year: III / Semester: VI										
S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	BCA-NEP-611	SPT-VII Advance Computer Forensics	C1	4	0	0	25	75	100	4
2	BCA-NEP-613	SPT-VIII Artificial Intelligence	C2	4	0	0	25	75	100	4
3	BCA-NEP-603	1. Mobile Computing 2. E-Commerce 3. Real Time System	DSE	4	0	0	25	75	100	4
4	BCA-NEP-IP-II	Industrial Project	Minor Industrial Project	0	0	10	100	0	100	5
5	BCA-NEP-612P	SPT-VII Advance Computer Forensics Lab	CORE LAB 1	0	0	4	25	25	50	2
6	BCA-NEP-614P	SPT-VIII Lab Artificial Intelligence Lab	CORE LAB 2	0	0	4	25	25	50	2
7	*Code will be decided by parent department	GE-III(To be opted by the students as per the given electives in the list attached)	GE-III(Mandatory)	4	0	0	25	75	100	4
8	BCA-NEP-607P	MOOC/NPTEL	SEC	4	0	0	50	0	50	4
9	RP-II AUDIT	Research Project-II@	AUDIT	0	0	0	50	0	50	NC
		Grand Total		**20**	**0**	**18**	**350**	**350**	**700**	**29**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										
NOTE: @RESEARCH PROJECT – II is a Noncredit courses (Audit Courses) and Student needs to qualify it but the marks will not be added in total marks										

Format-1

Format -1

NEP-2020 IMPLEMENTATION 3 STEPS PLAN (FORMAT-1,2 & 3)
CBCS: Statement of Credits distribution

College/School: SOCSA **Programme: BCA(CCS)** **Duration: UG (6 Sem.), UG (Hons./Research) 8 Sem., PG (4 Sem.)**	**Credit range:Minimum 120 for UG** **160 for UG (Hons.), 80 for PG** **(Suggested by CBCS-NEP Committee)**

Course	Credit	Semester	Core Major	Dse Minor	AECC	SEC **	GE Interdisciplinary	General Elective	Value Added Course (VAC) (1)	Industrial Training/ Survey / Research Project (4)	Total Credits
Certificate Course in Computer Applications		**Ist**	**C 1** 1). C Programming (Th 3+P 2) **C 2** 2).Mathemat-ics for Computing-I (Th 4) **C 3** 3). Introduction To Cloud (Th3+P2)	**DSE 1** **1).**ERP(Th 4)/ **2).** M-Commerce (Th 4)	**AECC 1** English Communic ation/ (Th. 3)	**SEC 1** Computer Basics and Office Automati-on Tools (Th1 +P2)		NCC	**VAC 1** Indian Ethos and Modern Managem -ent (Th2)		26 (Excludin g NCC)
		2nd	**C 4** 1). Advance C Programming (Th3+P2) **C 5** 2). Mathematics for Computing-II (Th4) **C 6** 3). Linux Administration with Scripting (Th3+P2)	**DSE 2** 1). Digital Marketing (Th4)/ 2). Informatio n System (Th4)	**AECC-2** Environme nt and Ecology (Th 4 P 2)	**SEC 2** IPR (2) Through NPTEL or IIMTU)		**GE 1** General Elective (To be opted from other school of IIMTU)			29 (Excludin g NCC)
Entry and Exit point											

Diploma in Computert Applications		**3rd**	1). Data Structure and Algorithm using C (Th3+P1) 2). Operating Systems (Th 4) 3). Advance Cloud Security-I (Th3+P1)	1). Block Chain (Th4)/ 2). Data Mining and Data Warehousi-ng (Th4)	AECC 3-Human values& Professiona l Ethics (Th. 3 Cr.)	Basics of SQL (Th 1+P1)	GE 2 (Th. 4 Cr.) A/B	NCC	Cyber Security (Th3)		28 (Excludin g NCC)
		4th	1). OOPs using Java (Th3+P1) 2). Software Engineering (Th4) 3). Advance Cloud Security-II (Th 3+P1)	Computer Based Numarical and Statistical Techniques / IOT (Th4)	AECC 4-Professiona l Skills (Th. 3Cr.)	E&I (Th 2) Through NPTEL or IIMTU)	GE-3 A/B (Th. 4 Cr.)	NCC			25 (Excludin g NCC)
Entry and Exit point **Note:-** Summer Internship in between 4th and 5th Sem. During session break (6-8 weeks) (Credit-4) and will be evaluated in next Semester.											

Bachelor of Computer Applications in Cloud and Cyber Security		**5th**	1). AI (Th 3+P1) 2). Python Programming (Th3+P1) 3). Advance Cyber Security and Computer Forensic (Th3+P1)	1). Big Data (Th4)/ 2). Data Science (Th4)				NCC	Health & Wellness (Th2)	Summer Internship in between 4th and 5th Sem. During session break (6-8 weeks) (Credit-4) .Field Visit/Industrial Project/ Final Year Research Project-I (Credit-2, for 3 years programmes)	24 (Excluding NCC)
		6th	1). Advance Computer Forensic (Th3+P1) 2). Web Development (Th3+P1) 3). Machine Learning Techniques (Th3+P1)	1). Natural Language Processing (Th 4)/ 2). Computer Vission (Th 4)		SEC 3-MOOCs/NPTEL		NCC		Field Visit/Industrial Project/ Final Year Research Project-II (Credit-4, for 3 years programmes)	20 (Excluding NCC)

Note: For 04 years undergraduate programmes, research projects will be of 6 credits each in last 02 semesters.
*General Elective: Certificate will be provided to the students opted for NCC apart from degree.
** One SEC must be E&I and IPR (Can be through NPTEL or IPR can be from TIFAC, DST)

To be implemented from 2027-2028

M.C.A		7th	C13- C14-	DSE 7- A/B +DSE-8	AECC 5-			NCC	VAC-1		23 (Excluding NCC)
		8th	C15- C16-	DSE-9 A/B +DSE-10	AECC 6- Research &Publication Ethics	SEC 4- MOOCs (E&I/IPR)	GE -4 A/B	NCC	VAC-2	Seminar/Industrial Training/ Research (Credits-4)	26 (Excluding NCC)
		9th	C17- C18-	DSE-11 A/B DSE-12			GE-4 A/B	NCC	VAC-3	Seminar/Industrial Training/ Research (Credits-4)	28 (Excluding NCC)
		10th	C-19 C-20			SEC 5- MOOCs		NCC		Research Project (Credits -16)	20 (Excluding NCC)

Format-2

IIMTU-NEP Implementation: Format-2 BCA (Cloud and Cyber Security)

Program	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester	Prerequisite	Elective (For other faculty)
CERTIFICATE COURSE	FIRSTYEAR(55 Cr.)	SEMESTER -I (26Cr.)	i) C1	3	3	40	'C' Programming	5		
			C1 (lab)	2	2	20	'C' Programming Lab			
			C2	4	4	40	Mathematics for Computing-I	5		
			C3	3	3	40	Introduction to Cloud	5		
			C3 (lab)	2	2	20	Introduction to Cloud Lab			
			ii) DSE1	4	4	40	ERP	5		
							M-Commerce			
			iii) AECC 1	3	3	40	English Communication	5		
			iv) SEC1	1	1	10	Computer Basics and Office Automation Tools	5		
				2	2	20	Computer Basics and Office Automation Tools (Lab)			
			v) VAC 1	2	2	30	Indian Ethos and Modern Management	5		
		SEMESTER – II (29 Cr.)	i) C4	3	3	40	Advance C Programming	5		
			C4 (lab)	2	2	20	Advance C Programming lab	5		
			C5	4	4	40	Mathematics for Computing-II	5		
			C6	3	3	40	Linux Administration with Scripting	5		
			C6 (lab)	2	2	20	Linux Administration with Scripting Lab			
			ii) DSE 2	4	4	40	Digital Marketing	5		
				4	4	40	Information System			
			iii) AECC 2	2	2	20	Environment & Ecology	5		
							Environment & Ecology Lab			
			iv) SEC 2	2	2	30	IPR			

Note:- Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.

Programme Outcome:	**Programme Specific Outcome:**
PO_1	PSO_1
PO_2	PSO_2
PO_3	PSO_3
***Program Outcome and Program Specific Outcome – See Annexure – 1**	PSO_4
@List is attached in Annexure – 2	

Programme	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester)	Prerequisite	Elective (For other faculty)
DIPLOMA COURSE	SECOND YEAR (44 Cr.)	SEMESTER –III (24 Cr.)	i) C7	3	4	45	Data Structure and Algorithm using C	5		
			C7 (lab)	1	4	10	Data Structure and Algorithm using C lab			
			C8	4	4	40	Operating System	5		
			C9	3	4	40	Advance Cloud Security-I	5		
			C9 (lab)	1	4	10	Advance Cloud Security Lab			
			ii) DSE 3	4	4	40	Block Chain	5		
							Data Mining and Data Warehousing			
			iii) AECC 3	3	4	40	Human Values and Professional Ethics	5		
			iv) SEC 3	1	4	40	Basics of SQL	5		
				1	4	40	Basics of SQL			
			v) VAC 2	3	4	40	Cyber Security	5		
Note:- Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.										
		SEMESTER –IV (19 Cr.)	i) C10	3	4	45	OOPs using Java	5		
			C10 (lab)	1	4	10	OOPs using Java lab			
			C11	4	4	40	Software Engineering	5		
			C12	3	4	40	Advance Cloud Security-II	5		
			C12 (lab)	1	4	10	Advance Cloud Security Lab			
			ii) DSE 4	4	4	40	Computer based Numerical and Statistical Techniques IOT	5		
			iii) AECC 4	3	4	40	Professional Skills	5		
				4			Summer internship in between 4th and 5th sem.			
Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.										

Programme Outcome:	**Programme Specific Outcome:**
PO_1	PSO_1
PO_2	PSO_2
PO_3	PSO_3
***Program Outcome and Program Specific Outcome – See Annexure – 1**	PSO_4
@List is attached in Annexure – 2	

Programme	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester)	Prerequisite	Elective (For other faculty)
DEGREE COURSE	THIRD YEAR (42 Cr.)	SEMESTER –V (18 Cr.)	i) C13	3	4	45	Artificial Intelligence	5		
			C13 (lab)	1	4	10	Artificial Intelligence Lab			
			C14	3	4	40	Python Programming	5		
			C14 (lab)	1	4	40	Python Programming lab			
			C15	3	4	40	Cyber Security and Computer Forensic	5		
			C15 (lab)	1	4	10	Cyber Security and Computer Forensic lab			
			ii) DSC 5	4	4	40	Big Data Data Science	5		
			iii) VAC 2	2	4	40	Health and Wellness			
				4			Industrial Training/Survey/Research Project			
		SEMESTER –VI (16 Cr.)	i) C16	3	4	45	Web Development	5		
			C16 (lab)	1	4	10	Web Development Lab			
			C17	3	4	40	Advance Computer Forensic	5		
			C17 (lab)	1	4	10	Advance Computer Forensic Lab			
			C18	3	4	40	Machine Learning Techniques	5		
			C18 (lab)	1	4	10	Machine Learning Techniques Lab			
			ii) DSE 6	4	4	40	Natural Language Processing Computer Vision	5		
				4			Industrial Training/Survey/Research Project			
Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year										

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Annexure -1

Programme Outcome:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Programme Specific Outcome:

PSO1: The graduates are proficient in fundamental principles and methods of Computer Science, Mathematical and Scientific reasoning and are able to:

- Apply fundamental concepts of integration, differentiation, vector calculus, probability & statistics, and discrete mathematics.
- Design, create & evaluate algorithms appropriate to specific problems.

PSO2: The graduates have understanding for:

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.	▪ Demonstrate capability for computers, computer network and server environments and there troubleshooting. ▪ Capacity to handle cloud computing environment and solutions. ▪ Well defined knowledge for solving problems of security and threats in information knowledge domain.

Format-3

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mathematics for Computing-I**
Course Code: 24BCACCS-102	**Title: Mathematics for Computing-I**

Course Objectives:

CO1: Compute the rank and inverse of a matrix and solve system of linear equations.
CO2: Computation of Limits of Various Types of Functions, Continuity over an Interval, to find Intermediate Value Theorem and type of Discontinuities.
CO3: Understand the Derivatives, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation, Successive Differentiation.
CO4: Use of different theorems like Rolle's Theorem, Mean Value Theorem, Leibnitz Theorem, Partial Differentiation, Euler's Theorem.
CO5: Understanding of Integral as Limit of Sum, Riemann Sum, Fundamental Theorem of Calculus, Indefinite Integrals.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Determinants:** Definition, Minors, Cofactors, Properties of Determinants, **Matrices**: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramer's Rule, Rank of Matrix, Eigen Vectors of a Matrix, Cayley-Hamilton Theorem (without proof)	8
II	**Limits & Continuity**: Limit at a Point, Properties of Limit, Computation of Limits of Various Types of Functions, Continuity at a Point, Continuity Over an Interval, Intermediate Value Theorem, Type of Discontinuities.	8
III	**Differentiation:** Derivative, Derivatives of Sum, Differences, Product & quotients, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation, Successive Differentiation.	8
IV	**Application of Differentiation:** Rolle's Theorem, Mean Value Theorem, Expansion of Functions (Maclaurin's & Taylor's), Indeterminate Forms, L' Hospitals Rule, Maxima & Minima, Leibnitz Theorem, Partial Differentiation, Euler's Theorem.	8
V	**Integration:** Integral as Limit of Sum, Riemann Sum, Fundamental Theorem of Calculus, Indefinite Integrals, Methods of Integration Substitution, By Parts, Partial Fractions, Integration of Algebraic and Transcendental Functions,	8

	Definite Integral.	

Text Books:

1. Babu Ram, "*Engineering Mathematics*", Pearson Education
2. H.K. Dass, "*Advanced Engineering Mathematics*", S. Chand & Company

Reference

1. Erwin Kreyszig, "*Advanced Engineering Mathematics*", John Wiley & Sons.
2. B. S. Grewal, "*Elementary Engineering Mathematics*", Khanna Publishers.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to find the rank and inverse of matrix.
CO2: Understand the various types of Functions and the concept of continuity.
CO3: Able to understand the Chain Rule and find the Derivatives of Composite Functions and Logarithmic functions.
CO4: Able to use the different theorems of differentiation.
CO5: Able to solve the calculus problems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: ERP**
Course Code: 24BCACCS-104-1	**Title: ERP**

Course Objectives:

CO1: Understand what an enterprise is, how it can be managed with ERP?
CO2: To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
CO3: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 Theory 1 Hr = 1 credit

Units	Contents	No. of Lectures Allotted
I	What are Enterprise, Enterprise Resource Planning, Evolution and Structure of ERP, Basic ERP Concepts, Benefits and Risks of ERP**?**	**8**
II	ERP Implementation: Objectives, Introduction, ERP Implementation Methodology, Evaluation Of The Various ERP Packages.	**8**
III	ERP Business: Selection Criteria For ERP Packages, Implementation of ERP Packages	**8**
IV	ERP Market Place: Objectives, Introduction, Reasons for the Growth of The ERP Market.	**8**
V	**ERP & E-COMMERCE:** Understanding E-Commerce, Distinct Categories Of E-Commerce, Categories Of E-Commerce, and Relevance Of ERP With E-Commerce.	**8**

Text Books

1. Alexis Leon, "ERP Demystified", Tata McGraw–Hill Education.
2. Vinod Kumar Garg, N K Venkitakrishnan, "*Enterprise Resource Planning–Concepts and Practice",* PHI.

Referential Books

1. Joseph A. Brady, Ellen F. Monk, Bret J. Wagner, "Concepts in Enterprise Resource Planning", Course Technology Cengage Learning.
2. Rahul V. Altekar, *"Enterprise wide Resource Planning"*, Tata McGraw Hill.

Evaluation / Assessment Methodology	
	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to Understand what an enterprise is, how it can be managed with ERP?

CO2: Able to provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.

CO3: Able to focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.

CO4: Able to train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.

CO5: Able to aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: M-Commerce**
Course Code-24BCACCS-104-2	**Title: M-Commerce**

Course Objectives:

CO1: Understand what M-Commerce is, how it can be managed, relation with E-Commerce?
CO2: To provide a contemporary and forward-looking on theory and practice of M- Commerce.
CO3: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: To train the students to develop the basic understanding of how M- Commerce, enriches the business organizations in achieving a multidimensional growth.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Units	Contents	No. of Lectures Allotted
I	**Introduction to Mobile commerce:** Definition, Scope of Mobile Commerce, Benefits and Limitations of M-Commerce, M-Commerce Framework, M-Commerce business Models, E-Commerce Vs M-Commerce, Impact of M-Commerce.	8
II	**Mobile commerce technology :** Types of Mobile Clients (Mobile Phones, PDAs, Laptop Computers, Vehicle-mounted Devices, Hybrid Devices etc.). Device Limitations: Considerations for user Interface and Application Design, Device Location Technology: GPS, Triangulation. Mobile Client Software: Mobile Device Operating Systems, Micro browsers, Mobile Device Communications Protocols: WAP, I-Mode, Mobile Device Page Description Languages, Mobile Device Application Software.	8
III	**Wireless communications of technology** Wireless Wide Area Network (WWAN) Technology: Cellular Systems, 2G (CDMA, TDMA, GSM), 2.5G (GPRS, EDGE), 3G (WCDMA/UMTS, CDMA2000), 4G, 5G. Wireless Local, Area Network (WLAN) Technology (Wi-Fi), Wireless Metropolitan Area Network (WMAN) Technology (WiMAX), Wireless Personal Area Network (WPAN) Technology (Bluetooth).	8

IV	**M-Commerce applications:** Mobile Financial Services, Mobile Advertising, Mobile Payment, Mobile Ticketing, Mobile Product Location and Shopping, Mobile Business Services, Mobile Auction, Mobile Entertainment, Mobile Office, Mobile Distance Education.	**8**
V	**BUSINESS-TO-BUSINESS MOBILE E-COMMERCE** Enterprise Enablement, Email and Messaging, Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare), Field Sales Support (Content Access, Inventory), Asset Tracking And Maintenance/Management, Remote IT Support, Customer Retention (B2C Services, Financial, Special Deals), Warehouse. **Future of M- Commerce:** Future challenges, security, scalability.	**8**

Text Books

1. Advanced E-Commerce and Mobile Commerce, Divakara Reddy N., Suman M., Himalaya Publication house Pvt. Ltd., ISBN 978-93-5202-139-0, New Delhi.
2. MOBILE COMMERCE, Bandyopadhyay, Karabi, PHI Learning Pvt. Ltd., Delhi, Edition II, ISBN: 9789391818425.

Referential Books

1. Brian E. Mennecke, Troy J. Strader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.
2. P. J. Louis, "M – Commerce Crash Course", McGraw – Hill Companies February 2001.
3. Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" Cambridge University Press March 200l.

Evaluation / Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to Understand what M-Commerce is, how it can be managed, relation with E-Commerce?
CO2: Able to provide a contemporary and forward-looking on theory and practice of M- Commerce.
CO3: Able to focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: Able to train the students to develop the basic understanding of how M- Commerce, enriches the business organizations in achieving a multidimensional growth.
CO5: Able to at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Feature Engineering**
Course Code:25BCACCS-104-3	**Title: Feature Engineering**
Course Objectives:	
CO1: Extract useful features from data and convert them to features. CO2: Learn how to deal with infrequent, rare, and unseen categories. CO3: Learn to transform categorical variables into no. while capturing meaningful information. CO4: Learn to convert numerical variables into discrete ones. CO5: Learn techniques to pre-process data and build more powerful machine learning models.	
Nature of Paper: DSE	
Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)	
L: 4 T: 0 P: 0 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4 Hrs./Week= 4 Credits)	

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Feature Engineering, Importance of feature engineering, Evaluation of machine learning algorithm and Feature engineering procedures. Feature Understanding: Feature Improvement-cleaning datasets, Feature Selection-removing bad attributes, Feature construction, Feature Transformation, Feature learning	8
II	**Data Pre-processing and Missing Values:** Handling missing values, identification, imputation techniques (mean, median, regression-based), and impact on models. Basics of Feature Representation: Scalars and Vectors, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling).	8
III	**Encoding and Transformation Techniques Handling categorical variables:** one-hot encoding, label encoding, and target encoding, Handling text data: bag-of-words representation, TF-IDF encoding, and word embeddings. Numerical transformations: handling skewed distributions, logarithmic transformations, and scaling techniques. Binning and discretization of continuous variables.	8
IV	**Feature Selection:** Importance of Feature Selection in Machine Learning, Goals of Feature Selection, Classes of Feature Selection Methodologies. Effect of Irrelevant Feature, Univariate feature selection: statistical tests and feature importance, Recursive Feature Elimination, Stepwise Selection.	8
V	**Feature Transformations:** Intuition, Derivation, Linear Projection, Variance and Empirical Variance - Vector Formulation, General Solution of the Principal	8

	Components, Transforming Features, Implementing PCA, PCA in Action, Considerations and Limitations of PCA, Use Cases	

Text Books:

1. Max Kuhn, Kjell Johnson, "Feature Engineering and Selection: A Practical Approach for Predictive Models" 1st Edition, Chapman & Hall/CRC Data Science Series, ISBN 13- 978- 1-138-07922-9.
2. Sinan Ozdemir, Divya Susarla, "Feature Engineering Made Easy", Packt Publishing, ISBN 978-1-78728-760-0

Reference

1. Alice Zheng & Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for data scientist", Oreilly Publications

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Create new features from existing ones.
CO2: Impute missing data and encode categorical variables.
CO3: Transform numerical variables and change their distribution.
CO4: Perform discretization, remove outliers, and extract features from date & time.
CO5: Reduce dimensionality of data using PCA.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA(CCS)**	**Year** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Basics of Data Analytics using Spread Sheet**
Course Code: 24BCACCS-104-4	**Title: Basics of Data Analytics using Spread Sheet**

Course Objectives:

CO1: To familiarize students with the fundamental concepts of data analytics, types of data, applications, and basic use of spreadsheet tools for data handling and analysis.
CO2: To enable students to acquire foundational skills in Microsoft Excel for entering, organizing, and managing worksheet data, performing basic operations, and applying simple formulas and functions effectively.
CO3: To equip students with the skills to create and use formulas, apply various functions, generate and format charts, and perform basic data analysis using spreadsheet tools.
CO4: To develop students' ability to visualize and analyze data by creating and customizing charts, and applying essential spreadsheet data analysis tools.
CO5: To enhance students' proficiency in advanced Excel functions for conditional analysis, data visualization, and automation using macros.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week= 4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Data Analytics:** Understanding data and its types (Structured, Unstructured, semi structured), What is Data Analytics, Type of Data Analytics, Application of data Analytics, Introduction to spread sheet tools (Excel, Google sheets)	8
II	**Introduction to Excel Basics:** Entering and editing worksheet data, Performing basic worksheet operations, Use of simple arithmetic operations, Working with excel ranges and tables, Working with Formulas and Functions, Selecting Columns & Rows, Changing Column Width & Row Height, Auto fitting Columns & Rows, Hiding/Un hiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell.	8
III	**Creating Formulas:** Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum, Using text functions to manipulate text, Using date and time functions, Using formulas for financial analysis.	8
IV	**Spreadsheet Charts:** Creating Charts, Different types of chart, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend,	8

	Showing and Hiding the Data Table **Data Analysis:** Sorting, Filter, Text to Column, Data Validation	
V	**Advanced Excel Functions for Data Analysis:** Using formulas for Conditional Analysis, Use the IF function to evaluate a condition and return values based on the result, Apply the AND and OR functions to evaluate multiple conditions, Perform conditional calculations(SUMIF, COUNTIF, AVERAGEIF), Data Visualization with Excel Demonstration of creation of a bar chart representing sales data for different months. Customize the appearance of a chart, including colors, fonts, titles, legends and axis labels, Making Macros Recording Macros, Running Macros, Deleting Macros	8

Text Books:

1. Excel 2019 bible, Alexander, M., Kusleika, R., & Walkenbach, J. (2018), John Wiley & Sons.
2. Excel data analysis for dummies, Nelson, S. L., & Nelson, E. C. (2014), John Wiley & Sons.
3. Data Analysis with Microsoft Excel , Berk, K. N., & Carey, P. (1998), Pacific Grove, CA: Duxbury Press.

Reference

1. Excel Data Analysis Modeling and Simulation., Hector, G. (2019), Spinger.
2. Microsoft Excel data analysis and business modelling, Winston, W. (2016), Microsoft press.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course:

Course Learning Outcomes:

CO1: By the end of the course, students will be able to identify different types of data, explain data analytics concepts, recognize its applications, and perform basic data operations

CO2: Students will be able to create and edit worksheets, manage rows, columns, and ranges, apply basic arithmetic and functions, and format spreadsheet data for efficient presentation and analysis.

CO3: Students will be able to apply formulas and functions for calculations and text manipulation, create and customize charts, and use spreadsheet features like sorting, filtering, and data validation for effective data analysis

CO4: By the end of the course, students will be able to design and format various chart types, modify chart elements, and perform data analysis using sorting, filtering, text-to-column, and data validation features.

CO5: By the end of the course, students will be able to perform conditional calculations using advanced functions, create and customize charts for data presentation, and automate repetitive tasks through recording and managing macros.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA (CCS)**	**Year: I** **Semester: I**
Credits: 2 **Theory: 2** **Practical: 0**	**Course: Computer Basics and Office Automation Tools**
Course Code:24BCACCS-105	**Title: Computer Basics and Office Automation Tools**

Course Objectives:
CO1: To understand the basic knowledge of computer about its generations and windows.
CO2: To know the concept of Algorithm and Flowchart.
CO3: To understand the concept of MS Word.
CO4: To understand the student will knowledge enter data in Excel, arrange data format data, how to use various functions sort information.
CO5: To understand the concept of Power Point Presentation.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 40% Marks / 2 Credits (Internal + ESE)

L: 2
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Computers:** Introduction, Characteristics of Computers, Block Diagram of Computer, Generations, Types of Computers and Their Features, Types of Programming Languages, Types of Memory, RAM, ROM, Secondary Storage Devices (FD, CD, DVD, HDD, Pen drive), Input and Output Devices. **Internet and its Applications:** Introduction, Usage, Browser, Websites, Protocol, Domain Name, IP address, E-Mail, FTP, World Wide Web. **Introduction to File Formats with Types and Extension:** Text file, PDF file, JPG file, GIF file, ZIP file.	8
II	**Algorithm and Flowcharts:** Definition, Characteristics, Advantages and Disadvantages, Symbols of Flow Chart. **Software:** Introduction of software, Types of software; Application Software, System Software, Open-Source Software. **Operating System and Services:** Types of Operating System, Features of Operating System, Functions and Services of Operating System. DOS – History, Files and Directories, Internal and External Commands.	8
III	**Introduction to Ms-WordWorking with Documents** -Opening & Saving files, editing text documents, Inserting, Deleting, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Formatting page & setting Margins. **Formatting Documents -** Setting Font styles, Font selection- style, size, color	8

	etc, Type face - Bold, Italic, Underline.	
IV	**Introduction to Microsoft Excel:** Spread Sheet & its Applications, Opening Spreadsheet, Menus - main menu, Formula Editing, Formatting, Toolbars, Using Icons, Shortcuts. **Working with Spreadsheets-** opening, saving files, setting Margins, converting files to different formats (importing, exporting, sending files to others)	8
V	**Basic of Microsoft Power Point:** Introduction to presentation – Opening new presentation, Different presentation templates, setting backgrounds, Selecting presentation layouts. **Creating a presentation** - Setting Presentation style, Adding text to the Presentation.	8

Text Books:

1. E .Balagurusawy, V.Rajaraman "*Office Automation Tool"*.McGraw-Hill.
2. Kevin Pitch*"MS-Office Windows*".Dinesh Maidasani MS Office.
3. Pradeep K. Sinha, Computer Fundamentals,

Reference

1. Priti Sinha ,Pradeep K. Sinha" *Office Automation Tool*".6th Edition

Evaluation/Assessment Methodology

	Max. Marks- 25
1) Class tasks/ Sessional Examination	5
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	5
5) ESE	15
Total:	**25**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand will get the basic knowledge of computer about its generations and types Windows.
CO2: Able to understand the concept of Algorithm and flowcharts.
CO3: Able to understand the concept of MS word.
CO4: Able to understand the student will the basic knowledge enter data in excel, arrange data format data, how to use various functions sort information.
CO5: Able to understand the concept of MS power point.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Computer Basics and Office Automation Tools Lab**
Course Code: 24BCACCS-108P	**Title: Computer Basics and Office Automation Tools Lab**

Course Objectives:
CO1: To understand Office tools course would enable the students in crafting professional word documents, excel spread sheets, power point presentations using the Microsoft suite of office tools.
CO2: To understand Familiarize the students in preparation of documents and presentations with office automation tools.
CO3: To understand Student will get the basic knowledge to create a file in MS word and format the files.
CO4: To understand Create different types of Charts and Tables.
CO5: To understand Changing background of windows desktop, creating shortcut how to display toolbar.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2(In Hours/Week)
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Understanding the desktop, taskbar, and start menu. Navigating files and folders, understanding different views, and managing files. How to create, rename, and organize folders. How to install new programs and remove unwanted ones.	1
2.	Create a Resume and other document using the table and shapes, Font color, Font size Text highlight color, Page number, Margins, Watermark, Page border, Page color, Align text.	1
3.	Create a flowchart using, a. Proper shapes like ellipse, arrows, rectangle, and parallelogram. b. Use grouping to group all the parts of the flowchart into one single object.	1
4.	Create a table using table menu with, a. At least 5 columns and 10 rows. b. Merge the first row into one cell. c. Merge the second row into one cell, then split the second row into three cells. d. Use proper table border and color	1
5.	Create a table using two columns, a. The left column contains all the short-cut keys and right side column contains the function of the short-cut keys. b. Insert a left column using layout option. Name the heading as Serial No.	1

6.	Opening Microsoft Excel Cells Filling in cells Selecting, Copying, Cutting, and Pasting Pasting Formulas Inserting or deleting row or columns Changing Column Width Formatting cells Changing fonts Saving an excel file	1
7.	Create a table "Student result" with following conditions. a. The heading must contain, Sl. No., Name, Mark1, Mark2, Mark3, Total, average and result with manual entry. b. Use formulas for total and average. c. Find the name of the students who has secured the highest and lowest marks. d. Round the average to the nearest highest integer and lowest integer (use ceiling and floor function respectively).	1
8.	Create a Student Table in MS-Access with the following features: a. Roll Number b. Student Name c. Class d. Marks in Subject 1, Subject 2, Subject 3 e. Total f. Average g. Result	1
9.	Create a Personal Information table in MS-Access with the following fields: a. First Name b. Middle Name c. Last Name d. Nationality e. Gender f. Temporary Address g. Permanent Address. Generate a Form and Report.	1
10.	Create a minimum of 10 slides with a slide theme appropriate for the topic.	1

Reference / Text Books:

- Office Automation Tools Lab/MS. Word:" by M .L.Humphrey".
- Office Automation Tools Lab/MS power point/MS. Access:" by MOIRA Stephen,. Kevin Pitch.

Evaluation/Assessment Methodology

Max. Marks:25

1) Class tasks/ Sessional Examination	10
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	15
Total:	**25**

Program Learning Outcomes:

PO1: Students will be able to develop to create the folder, files based on office automation tools.

PO2: Students will be able to understand create the resume and all function used in MS word.
PO3: Students will be able to understand create the Mark sheet and all function used in MS excel.
PO4: Students will be able to understand Create a Student Table in MS-Access with the following features.
PO5: Students will be able to understand Create a minimum of 10 slides with a slide theme appropriate for the topic.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Problem solving techniques using 'C' Language**
Course Code: 25BCACCS-101	**Title: Problem solving techniques using 'C' Language**

Course Objectives:
CO1: Explain the needs of programming language.
CO2: Learn Conditional and Iterative Control Statements in 'C' language.
CO3: Students will be able to learn the basics of functions in 'C' language.
CO4: Students will be familiar with uses of an array.
CO5: Students will be familiar with File handling programs to perform read write operations and how to use functions in 'C' language.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L:3
T:0
P:0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to 'C' Language:** History, C Character Set, Tokens, Keywords, Constants, Identifiers, Variables, Data Types, Comments, Structures of 'C' Program. Assignment Operators, Expressions, Statements, Arithmetic Expressions. **Storage Classes:** Automatic, External, Static & Register.	8
II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, go to Statement, Loops (for, while, do-while) in C, Nested Loops, break and continue Statements.	8
III	**Functions:** Advantages of Functions, declaring a Function, defining a Function, calling a Function, Argument Passing – Call by Value, Call by Reference, Types of Functions, Recursion.	8
IV	**Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data from Array, Multi-Dimensional Arrays.	8
V	**File Handling:** Introduction, File Types- Text, Binary, The File Pointer, Opening a File, Closing a File, Reading and Writing a File, File Handling Functions: fgetc(), fputc(), fputs(), fgets(), fprintf(), fscanf(), fwrite(), fread(), fseek().	8

Text Books:
1. Stephen W. Sagman & Gail Taylor,"*MS-Office 2000For Windows*", Peachpit Press.
2. Balaguruswamy, "*Programming in ANSI C",* Tata Mc.Graw-Hill education.

3. Yashwant Kanetkar, *"Let us C",* BPB Publications
Reference 1. V. Rajaraman, "*Fundamental of Computers*", Prentice-Hall of India. 2. V Rajaraman, "*Computer Basics and C Programming*", PHI Learning 3. Ashok N. Kamthane, "*Programming in C*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand basic concepts of 'C' programming language.
CO2: Familiarize students with Conditional and Iterative Control Statement in 'C' language.
CO3: Students will be able to use functions in 'C' language.
CO4: Students will be able to solve problems with an Array.
CO5: Familiarize students with File Handling in 'C' language.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Introduction to Cloud using AWS**
Course Code: 25BCACCS-103	**Title: Introduction to Cloud using AWS**
Course Objectives:	
CO1: Understand the core concepts, evolution, characteristics, and models of cloud computing. CO2: Compare different cloud service models and analyze their usage in real-world scenarios. CO3: Apply virtualization concepts and basic server operations on platforms like VMware and AWS. CO4: Configure, manage, analyze and design AWS core services like EC2, EBS, and S3.	
Nature of Paper: Core	
Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)	
L:4 T:0 P:0(In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)	

Unit	Contents	No. of Lectures Allotted
I	What is cloud? History of Cloud Computing, How Cloud Computing works, Advantages and disadvantages, Application for Businesses, Cloud Service Providers, Cloud Computing Architecture, Cloud Computing Terminology.	10
II	Communication-as-a-Service (CaaS), Infrastructure-as-a-Service (IaaS), Monitoring-as-a Service (MaaS), Software-as-a-Service (SaaS), Platform-as-a-Service (Paas)	10
III	Types of Virtualization & its benefits, Introduction to various Virtualization OS o Vmware, KVM etc., Basics Commands, Apache Server, FTP Server, Installing Packages. IIS, FTP Server, Types, Priced and open source products in the market, overview of Public Cloud vendors, Overview of Private cloud products, Introduction to Amazon cloud-Pricing, Regions Availability Zones, Types of instances, Overview of different services of AWS, Consuming EC2 Instance Service from AWS (Creating Linux and Window Instances from the available AMIs connecting and remote control from the laptop).	10
IV	Consuming EBS block storage service from AWS-Adding volumes to Instances Taking snapshots, creating volumes from snapshot, attaching volumes to running instances, Using Elastic IP service-Assigning Public IP addresses and connecting from the internet, Installing additional software components on the instances, Automating installing and tasks at the booting time of a instance, Using the Load Balancers for load distribution(ELB), Installing command line tools, Using clouds watch service, Using Route 53	10

	service, Creating own AMIs, Virtual Private Cloud- Public and Private Network Scenarios, Using AWS S3 service, Creating a Mysql database using RDS service, IAM-Identity Access Management, Taking backups using command line tools, Understand AWS management tools, including auto scaling, EFS, SNS(Simple Notification System), CDN(Content Delivery Network), Glacier Services, mail Services, Doc Services	

Text Books:

1. Rajkumar Buyya, "Mastering Cloud Computing", Tata Mc. Graw-Hill Education.
2. Rajkumar Buyya, James Broberg& Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley.

Reference

1. Anthony T. Velte, Tobey J. Velte& Robert Elsenpeter, *"Cloud Computing: A Practical Approach*", Tata Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain how cloud computing works and its business applications.
CO2: Differentiate between IaaS, PaaS, SaaS, CaaS, and MaaS.
CO3: Describe types and benefits of virtualization.
CO4: Configure and develop cloud solutions using tools like auto scaling, CDN, SNS, and backup strategies.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Problem solving techniques using 'C' Language Lab**
Course Code: 25BCACCS-106P	**Title: Problem solving techniques using 'C' Language Lab**

Course Objectives:
CO1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.
CO2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements.
CO3: Students will be familiar with the concept of Arrays.
CO4: Students will be able to develop a Program with Functions Operations.
CO5: Students will be familiar with File handling programs to perform read-write operations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Write a program to display “hello world” in C.	1
2.	Write a program to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd.	1
3.	Write a program to check whether the entered year is a leap year or not (a year is a leap if it is divisible by 4 and divisible by 100 or 400.)	1
4.	Write a program to read a string and check for palindrome without using string-related functions (a string is a palindrome if its half is mirror by itself.	1
5.	Write a program to find the biggest among three numbers.	1
6.	Write a program to print a table of a given number.	1
7.	Write a program to print a factorial of a given number.	1
8.	Program to read two integer and two floating point numbers.	1
9.	Program to accept the marks of 5 subjects and finds the sum and percentage marks obtained by the student.	1
10.	Program to calculate the simple interest and compound interest (The Principal, Amount, Rate of Interest and Time are entered through keyboard).	1
11.	Program to calculate the area and circumference of a circle.	1

12.	Program that swaps values of two variables using a third variable.	1
13.	Program that swaps the values of two variables without using a 3rd variable.	1
14.	Program to calculate and print the area of triangle, where the three sides of the triangle is given as input.	1
15.	Program that checks whether the two numbers entered by the user are equal or not.	1
16.	Program to find whether a given number is even or odd.	1
17.	Write a Program to read two numbers and an operator (+, -, *, /) which performs the specified operation and display the result.	1
18.	Program to display the first N numbers.	1
19.	Program to print the sum of all numbers up to a given number.	1
20.	Program to print sum of even and odd numbers from 1 to N numbers.	1
21.	**Program** to demonstrate the use of **macros** using the #define preprocessor directive.	1
22.	Program that simply takes elements of the array from the user and finds the sum of these elements.	1
23.	Program to find the minimum and maximum element of the array.	1
24.	Write a C program that asks the user for their name and greets them with a welcome message	1
25.	Write a program to copy the content of one file to another file.	1

Reference / Text Books:

- The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie.
- C Programming: A Modern Approach" by K. N. King.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

PO1: Students can develop programs based on fundamental concepts of programming in C.
PO2: Students can solve problems based on Conditional and Iterative Control Statements.
PO3: Students can learn Complete Programming Concepts of Arrays.
PO4: Students can learn conceptual programming with Functions.
PO5: Students can perform File handling programs with read and write concepts

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Introduction to Cloud Lab using AWS**
Course Code: 25BCACCS- 107P	**Title: Introduction to Cloud Lab using AWS**

Course Objectives:
CO1: Understand the fundamental concepts and principles of cloud computing.
CO2: Familiarize students with IaaS, PaaS, SaaS, and their practical implementations.
CO3: Provide hands-on experience using popular cloud platforms like AWS, Azure, GCP.
CO4: Learn to deploy/manage virtual machines, containers, and serverless functions in a cloud environment.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=2Credits)

Unit	Contents	No. of Lectures Allotted
I	Install Virtual box/VMware Workstation with different flavours of Linux or windows OS on top of windows7 or 8.	2
II	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.	2
III	Install Google App Engine. Create hello world app and other simple web applications using python/java	2
IV	Use GAE launcher to launch the web applications.	2
V	Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm that is not present in Cloud Sim.	2
VI	Find a procedure to transfer the files from one virtual machine to another virtual machine.	2
VII	Find a procedure to launch virtual machine using trystack (Online Open stack Demo Version)	2
VIII	Install Hadoop single node cluster and run simple applications like word count.	2

Reference / Text Books:

1. Buyya, R., Vecchiola, C., & Selvi, S. T. Mastering Cloud Computing: Foundations and Applications Programming, Publisher: McGraw-Hill Education, ISBN: 978-1259029950
2. Velte, A. T., Velte, T. J., & Elsenpeter, R., Cloud Computing: A Practical Approach Publisher: McGraw-Hill, ISBN: 978-0071626941

If the course is available as Generic Elective then the students of following departments may opt it.

Evaluation/Assessment Methodology	
	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to :
CO1: Demonstrate a comprehensive understanding of cloud computing concepts and principles.
CO2: Set up a development environment within a VM.
CO3: Install Google App Engine and configure runtime environments (Python/Java).
CO4: Configure and manage cloud storage, databases, and networking resources effectively.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: CERTIFICATE **Class: BCA(CCS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mathematics for computing-II**
Course Code:24BCACCS-202	**Title: Mathematics for computing-II**

Course Objectives:

1. Basics of set theory and how to organize the data in meaningful manner.
2. Creating a relation between data and how to grouping of data with specific rules.
3. Partial order relation and basics of ordered theory with graphical representation with number system.
4. **3-D** Coordinate geometry their representation and basics of images and their representation.
5. Basics of differential equation and how to represent basic problems in the form of equations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L:4
T:0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit (4 Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
1	**Sets:** Sets, Subsets, Equal Sets, Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications.	**8**
2	**Relations and Functions:** Properties of Relations, Equivalence Relation, Partial Order Relation, Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.	**8**
3	**Partial Order Relations and Lattices:** Partial Order Sets, Representation of POSETS using Hasse diagram, Chains, Maximal and Minimal Point, Glb, lub, Lattices; Algebraic Systems, Principle of Duality, Basic Properties, Sub lattices, Distributed & Complemented Lattices.	**8**
4	**3D Coordinate Geometry:** Coordinates in Space, Direction Cosines, Angle Between Two Lines, Projection of Join of Two Points on a Plane, Equations of Plane, Straight Lines, Conditions for a line to lie on a plane, Conditions for Two Lines to be Coplanar, Shortest Distance Between Two Lines, Equations of Sphere, Tangent plane at a point on the sphere.	**8**
5	**Differential Equation:** First order and first degree differential equations, separation of variables, Homogeneous, linear, exact differential equations, second order linear equations with constant coefficients.	**8**

Text Books:-

1. C. L. Liu, "Elements of Discrete Mathematics", McGraw Hill Education.
2. H.K. Dass, "*Advanced Engineering Mathematics*", S. Chand & Company.
3. J.P Chauhan, " Mathematics", Krishna Publication.

Reference Books:-

1. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists", Reston Pub. Co.
2. Kenneth H. Rosen, "Discrete Mathematics and Its Applications: With Combinatorics and Graph Theory", Tata McGraw Hill Education

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:-

1. Understand the basics of set theory and how to organize the data in meaningful manner.
2. Analyze to create a relation between data and how to grouping of data with specific rules.
3. Apply Partial order Relation and basics of ordered theory with graphical representation with number system.
4. Application of 3-D Geometry their representation and basics of images and their representation.
5. Understand the basics of differential equation and how to represent basic problems in the form of equations.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: II**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Linux Administration with Scripting**
Course Code: 24BCACCS-203	**Title: Linux Administration with Scripting**

Course Objectives:
CO1: To understand and make effective use of Linux utilities and shell scripting language to solve problems
CO2: To implement in C some standard Linux utilities like mv, cp, ls, etc.
CO3: To Develop the skills the necessary for systems programming including file system programming, process and signal management and interposes communication
CO4: To develop the basic skills required to write network programs using sockets

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Linux History, overview, Principles, Getting started with GNOME and edit text files with gedit, manage files graphically and access remote system with Nautilus, getting help in graphical environment, Installation overview, directory structure, Installation Graphical, Configuring Local Services, date and time, Configuration of printer, Basic commands vi editor, manage users and groups.	10
II	Partition, Swap Creation Ivm, quota management and permanent mouting, Raid, Luks, Basic job control or cron use of helping command scp or ssh, filter command, Understand run levels.	10
III	Package installation with rpm, package installation with yum, use hard links, soft links, archives, Regular Expressions, Pipelines, and I/O Redirection, nfs, cifs and autofs, Ldap, Controlling Access to files, Analyzing and Storing Logs, Managing Processes, Tuning and Maintaining the Kernel, System Recovery Techniques, Enhance User Security, Apache Server.	10
IV	File Security with Gnupg, Route Network Traffic Secure Network Traffic, NTP Server Configuration, Web Server Additional Configuration, Basic SMTP Configuration, Caching-Only DNS Server, FTP, Squid, samba, dhcp, nis, pam, iptables, TCP Wrappers, Bash Scripting and tools, basic Shell Scripting, Graphical tools of Scripting (Zenith and dialogs)	10

Text Books:
1. Nemeth, E., Snyder, G., Hein, T. R., Whaley, B., & Mackin, D. (2017). UNIX and Linux system

administration handbook (5th ed.). Pearson.
2. Sobell, M. G. (2017). A practical guide to Linux commands, editors, and shell programming (4th ed.). Pearson.

Reference

1. Soyinka, W. (2016). Linux administration: A beginner's guide (7th ed.). McGraw-Hill Education.
2. Negus, C. (2020). Linux Bible (10th ed.). Wiley.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Nil

Course Learning Outcomes:

CO1: Students will be able to describe Linux history, principles, and graphical interfaces
CO2: Use ssh, scp, filter commands and manage quotas and mounts.
CO3: Configure file access controls, manage logs, and analyze system behavior.
CO4: Configure secure file transfer, DNS, FTP, DHCP, NIS, and mail servers.

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA (CCS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Digital Marketing**
Course Code- 24BCACCS-204-1	**Title: Digital Marketing**

Course Objectives

CO1. Understand the marketing in the digital era.
CO2. Understand the business drivers in the virtual world; such as social media, online branding, traffic building on web-site, ecommerce.
CO3. Understand the online tools for marketing.
CO4. To understand the contemporary digital revolution.
CO5. To Apply critical thinking and problem-solving skills to real-world digital marketing scenarios.

Nature of Paper: DSE 2

Minimum Passing Marks / Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0
Theory 1Hr = 1 credit

Units	Contents	No. of Lectures Allotted
I	Digital world: Marketing in the Digital Era, E-marketing. Building Website using Website/ Blog Foundations of analytics- Search engine optimization, Key Words, Key Word planner tools, SEO- One page and Off page Techniques: Indexing and Key word placing and content optimization.	8
II	Business Drivers in the Virtual World: Social media, Online Branding, Traffic Building, Web Business Models, E-commerce, E-marketing, Online Marketing, Online Consumer, Customer Relationship Management, Online Tools for Marketing	8
III	Contemporary Digital Revolution 5, Online Communities and Co-creation, The World of Facebook, Future of Marketing in gaming and Apps Engagement Marketing through Content Management, Online Campaign Management, Consumer Segmentation, Targeting, and Positioning using Online Tools, Market Influence Analytics in a Digital Ecosystem	8
IV	Email Marketing: Email marketing, Building an email list, Creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics, , Content strategy and Planning Mobile Financial Services, Mobile Advertising, Mobile Payment, Mobile Ticketing, Mobile Product Location and Shopping, Mobile Business Services, Mobile Auction, Mobile Entertainment.	8

V	Automation in Insurance, Healthcare, Sales Support (Content Access, Inventory), Asset Tracking and Maintenance/Management, Remote IT Support, DIGITAL MARKETING PROMOTION: Types of Various Ad Formats: PPC, Banners, Video Ads, App Ads, Facebook advertising, Twitter Advertising, YouTube Advertising, LinkedIn Marketing. Affiliate Marketing, Influence marketing.	8

Text Books

1. Advanced E-Commerce and Mobile Commerce, Divakara Reddy N., Suman M., Himalaya Publication house Pvt. Ltd., ISBN 978-93-5202-139-0.
2. Digital Marketing Strategy: An Integrated Approach to Online Marketing, Simon Kingsnorth., second edition, ISBN: 0749484225, Publisher Kogan Page

Referential Books

1. Digital Marketing, Publisher: Oxford University Press Author: Vandana Ahuja
2. Digital Marketing Strategy, Implementation, and Practice, Dave Chaffey; Fiona Ellis- Chadwick: 11th Edition, Pearson
3. Seema Gupta: Digital Marketing, McGraw Hill Education (India) Private Limited.

Evaluation / Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1. Able to understand the marketing in the digital era.
CO2. Able to understand the business drivers in the virtual world; such as social media, online branding, traffic building on web-site, ecommerce.
CO3. Able to understand the online tools for marketing.
CO4. Able to understand the contemporary digital revolution.
CO5. Able to understand critical thinking and problem-solving skills to real-world digital marketing scenarios

Format-3

IIMTU-NEPIMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Information System**
Course Code: 24BCACCS-204-2	**Title: Information System**

Course Objectives:
CO1: Understand the role of information systems in business operations and strategy.
CO2: Analyze and design information systems that meet organizational needs.
CO3: Gain familiarity with various types of information systems, such as ERP, CRM, and SCM.
CO4: Understand the ethical, legal, and social implications of information systems.
CO5: Explore emerging trends in information systems, such as cloud computing, big data, and cyber security.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Information Systems:** Definition and components of Information Systems, The role of IS in business and society, Overview of types of Information Systems, Information Systems in Organizations, Organizational structure and IS, IS for competitive advantage, Information systems management roles and structures.	8
II	**Information and communications technologies:** Communications technologies and networks, the internet. Data storage systems, files and databases. **Data and System Development:** Data Management, Database concepts, Data modeling and design, Introduction to SQL **Information Systems Development:** Information systems development approaches; life cycle, prototyping, incremental models. Systems analysis tasks, methodologies, modelling and agile methods. Data modelling. Systems implementation. System development life cycle (SDLC), Agile and Waterfall methodologies, Tools for IS development.	8
III	**Enterprise Systems:** Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supply Chain Management (SCM) **E-Business and E-Commerce:** E-Business models and strategies, E-Commerce platforms and technologies.	8
IV	**Cloud Computing and Big Data:** Introduction to cloud computing, Big Data technologies and analytics, Impact of cloud and big data on business, Open source software. Social networking.	8

	Cybersecurity and Ethical Issues: Cybersecurity fundamentals, Ethical and legal issues in IS, Data privacy and protection	
V	**Emerging Trends in Information Systems:** Artificial Intelligence and Machine Learning in IS, Blockchain technology, Internet of Things (IoT) and its impact on IS **Information Systems Strategy and Management:** IS strategy alignment with business strategy, IS governance and risk management, Future directions in IS management	8

Text Books:

- Laudon, K.C. and J.P. Laudon. Management Information Systems: Managing the Digital Firm. (New Jersey: Prentice Hall, 2019) sixteenth edition [ISBN 978-0135191798

Reference

- "Information Systems for Business and Beyond" by David T. Bourgeois.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar/Attendance	-
3) Assignments/TA	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcome

CO1: Able to identify role of information systems in business operations and strategy.
CO2: Design information systems that meet organizational needs.
CO3: Gain Knowledge and working with various types of information systems, such as ERP, CRM, and SCM.
CO4: Understand the ethical, legal, and social implications of information systems.
CO5: Able to work in emerging trends in information systems, such as cloud computing, big data, and cybersecurity.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Artificial Intelligence**
Course Code: 24BCACCS-204-3	**Title: Artificial Intelligence**

Course Objectives:

CO1: To understand about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: To study the concepts Propositional logics, predicate Logic.
CO3: To understand the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts.
CO4: To understand concepts of Prolog and Implement the Prolog Program.
CO5: To learning concepts of Expert system and Learning.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.= 1 Credit (4 Hrs./Week= 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).	**8**
II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, No deductive Inference Methods, Rules.	**8**
III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts	**8**
IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/output and Streams, Databases, Implementation of Concepts in Prolog.	**8**
V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition, Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice, Learning	**8**

	in Problem Solving, Learning from Example-Induction, Explanation Based learning.	

Text Books:

1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. Dan W. Patterson, *"Introduction to Artificial Intelligence& Expert Systems"*, PHI.
2. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.

Referential Books:

1. Stuart J. Russell &Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall.
2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: mathematics, statistics, and Computer programming.

Course Learning Outcomes:

CO1: Learnt about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: Learnt study the concepts Propositional logics, predicate Logic
CO3: Learnt the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO4: Learnt concepts of Prolog and Implement the Prolog Program.
CO5: Learnt concepts of Expert system and Learning.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA (CCS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Cloud Computing**
Course Code:24BCACCS-204-4	**Title: Cloud Computing**

Course Objectives:

CO1: Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
CO2: Apply the fundamental concepts in datacentres to understand the trade-offs in power, efficiency, and cost.
CO3: Identify resource management fundamentals, i.e., resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
CO4: Analyze various cloud programming models.
CO5: Apply the models to solve problems on the cloud.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits(Internal +ESE)

L: 4
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	What is cloud? History of Cloud Computing, How Cloud Computing works, Advantages and disadvantages, Application for Businesses, Cloud Service Providers, Cloud Computing Architecture, Cloud Computing Terminology.	8
II	Communication-as-a-Service (CaaS), Infrastructure-as-a-Service (IaaS), Monitoring-as-a Service (MaaS), Software-as-a-Service (SaaS), Platform-as-a-Service (Paas)	8
III	Types of Virtualization & its benefits, Introduction to various Virtualization OS o V Mware, KVM etc., Basics Commands, Apache Server, FTP Server, Installing Packages. IIS, FTP Server, Types, Priced and open-source products in the market, overview of Public Cloud vendors, Overview of Private cloud products, Introduction to Amazon Cloud-Pricing, Regions Availability Zones, Types of instances, Overview of different services of AWS, Consuming EC2 Instance Service from AWS (Creating Linux and Window Instances from the available AMIs connecting and remote control from the laptop).	8
IV	Consuming EBS block storage service from AWS-Adding volumes to Instances Taking snapshots, creating volumes from snapshot, attaching volumes to running instances, Using Elastic IP service-Assigning Public IP addresses and connecting from the internet, Installing additional software components on the instances, Automating installing and tasks at the booting time of a instance,	8

	Using the Load Balancers for load distribution(ELB), Installing command line tools, Using clouds watch service, Using Route 53 service, Creating own AMIs.	
V	Virtual Private Cloud- Public and Private Network Scenarios, Using AWS S3 service, Creating a MySQL database using RDS service, IAM-Identity Access Management, Taking backups using command line tools, Understand AWS management tools, including auto scaling, EFS, SNS(Simple Notification System), CDN(Content Delivery Network), Glacier Services, mail Services, Doc Services	8

Text Books:

1. Rajkumar Buyya, "Mastering Cloud Computing", Tata Mc. Graw-Hill Education.
2. Rajkumar Buyya, James Broberg& Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley.

Reference

1. Rajkumar Buyya, "Mastering Cloud Computing", Tata McGraw-Hill Education.
2. Rajkumar Buyya, James Broberg & Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", Wiley.
3. Anthony T. Velte, Tobey J. Velte& Robert Elsenpeter, *"Cloud Computing: A Practical Approach*", Tata McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
CO2: Apply the fundamental concepts in datacentres to understand the trade-offs in power, efficiency and cost.
CO3: Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
CO4: Analyse various cloud programming models.
CO5: Apply the models to solve problems on the cloud.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Linux Administration with Scripting Lab**
Course Code: 24BCACCS-207P	**Title: Linux Administration with Scripting Lab**

Course Objectives:
CO1: To write shell script programs to solve problems.
CO2: To implement some standard Linux utilities such as ls.cpetc using system calls.
CO3: To develop network-based applications and understand file structures and system communication.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a shell script that accept a file name starting and ending line numbers as arguments and display all the lines between given line no.	2
II	Write a shell script that delete all lines containing a specified word.	2
III	write a shell script to find the factorial of given integer	2
IV	Write a shell script that accept a list of file names as arguments count and report the occurrence of each word	2
V	Write a awk script to find the number of characters, words and lines in a file? 16 linked list respectively	2
VI	Write a C Program that makes a copy of a file using standard I/O and system calls?	2
VII	Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. whenever the argument is a file or directory.	2
VIII	write a shell script that list the all files in a directory.	2

Text book:

1. Sobell, M. G. (2017). A practical guide to Linux commands, editors, and shell programming (4th ed.). Pearson. ISBN: 9780134774602
2. Nemeth, E., Snyder, G., Hein, T. R., & Whaley, B. (2017). UNIX and Linux system administration handbook (5th ed.). Pearson. ISBN: 9780134277554

Reference Books:

1. Foster-Johnson, E., & Welch, J. C. (2005). Beginning shell scripting. Apress.
2. Robbins, A., & Beebe, N. H. F. (2005). Classic shell scripting. O'Reilly Media.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: To demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment.

CO2: Able to implement linux utilities.

CO3: To apply the concept of client-server communication by using sockets.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: II**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Data Structures**
Course Code: 25BCACCS-201	**Title: Data Structures**

Course Objectives:
CO1: Remember a brief description of Array data structures.
CO2: Analyze performance of Linked List and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.	8
II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists with implementation, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists.	8
III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deque, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal; Traversal of Binary Trees; Introduction of Binary Search Tree(BST).	9

	Graphs: Introduction, Terminology, Representation.	
V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Merge Sort, Heap Sort, Linear Search, Binary Search; Introduction of Hashing.	8

Text Books:

1. Aaron M. Tenenbaum**, "***Data Structures Using C***",** Pearson Education.
2. Samir Kumar Bandyopadhyay, K. N. Dey, "*Data Structures Using C",* Pearson Education.
3. Lipschutz (Schaum's Series), "*Data Structure with C",* Tata McGraw Hill Education.

Reference:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*", Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology	**Evaluation/Assessment Marks**
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: ***Problem Solving using C***

Program Learning Outcomes:

PO1: Remember the need of data structure for writing efficient Programs.
PO2: Analyze the performance of linked list with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structures.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Program: Certificate **Class: BCA(CCS)**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Structures Lab**
Course Code: 25BCACCS-206P	**Title: Data Structures Lab**

Course Objectives:
CO1: Remember a brief description of Array data structures.
CO2: Analyze performance of Linked List and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Write down difference between Data Type and Data Structure.	1
2.	Differentiate Linear and Non-Linear Data Structure.	1
3.	List operations on Data structure.	1
4.	Explain Linear and multidimensional array with memory implementation in primary memory including concept of row and column major.	1
5.	Give a brief overview of Sparse matrix its memory storage, types and examples.	1
6.	How do traversal work for forward and backward direction in doubly link list.	1
7.	WAP in C language for the Array Implementation of Stack.	1
8.	Write the C function for Push and Pop operations.	1
9.	Represent and analyze the concept of Stack with Link list representation.	1
10.	What are the various operations performed on the Queue?	1
11.	Write an algorithm to insert an element in a circular queue.	1
12.	Explain the different types Graph representations?	1
13.	Write down the Heap sort and give its worst case, best case and average case analysis.	1
14.	Write down the selection sort and give its worst case, best case and average case analysis.	1
15.	What is multilevel indexing in terms of tree indexes?	1

16.	What are the two methods of binary tree implementation? Explain them.	1
17.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.	1
18.	What is multilevel indexing in terms of tree indexes?	1
19.	How many passes are required for the elements to be sorted in quick sort? Explain in detail.	1
20.	Write down the function to insert an element into a queue, in which the queue is implemented as an array.	1
21.	WAP in C language for the Array Implementation of Stack.	1
22.	Write the routine to insert a element onto a queue.	1
23.	Write the complete concept of Linear Search.	1
24.	What are the applications of queue? Explain evaluation of Batch processing.	1
25.	How do you evaluate the Postfix, Prefix and Infix Expressions.	1

Reference / Text Books:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

PO1: Remember the need of data structure for writing efficient Programs.
PO2: Analyze the performance of linked list with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structures.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme:BSc/ BA/BBA/BCA/BTech Certificate/Diploma/Degree/ All UG Programme	**Year: I** **Semester: II**
Credits: 6 **Theory: 4** **Practical: 2**	**Course: Environment and Ecology**
Course Code: NHU-NPR-112 **NHU-NPR-112P**	**Title: Environment and Ecology** **Environment and Ecology Lab**

Course Objectives:

Subject comprised of various fields of Environmental science and their applications for the mankind. It meets the local to global requirement.

CO1: To appreciate the historical context of human interactions with the environment and to gain insights into the international efforts to safeguard the Earth's environment and resources.

CO2: To understand the concept of natural resources, identify types of natural resources, their distribution and use with special reference to India.

CO3: To develop a critical understanding of the environmental issues of concern

CO4: To describe the main types of ecosystems and their distribution in India and the world and to explain major conservation strategies taken in India.

CO5: To develop an understanding of pollution, its types and Control measures.

CO6: To gain a comprehensive knowledge of climate change, its science and response measures and to have an overview of national and global efforts to address climate change adaptation and mitigation.

CO7: To Explain major conservation strategies taken in India.

CO8: To Sensitize themselves to adverse health impacts of pollution.

Nature of Paper: AECC

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 1 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Unit	Contents	No. of Lectures Allotted
I	**Humans and the Environment:** The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment, Indic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. Environmental Ethics and emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.	**04**

II	**Natural Resources and Sustainable Development:** Overview of natural resources: Definition of resource; Classification of natural resources-biotic and abiotic, renewable and non-renewable. Biotic resources: Major type of biotic resources-forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges. Water resources: Types of water resources-fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water. Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources-coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.	**08**
III	**Environmental Issues-Local, regional & Global:** Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Pollution: Impact of sectoral processes on Environment; Types of Pollution- air, noise, water, soil, thermal, radioactive ;municipal solid waste, hazardous waste; transboundary air pollution; acid rain; smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Climate change. Disasters-Natural and Man-made (Anthropogenic)	**08**
IV	**Conservation of Biodiversity & Ecosystem:** Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics• forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.	**08**
V	**Environmental Pollution & Health:** Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants-carbon monoxide, lead, nitrogen oxides, ground-level ozone,	**08**

	particulate matter and sulphur dioxide; Other important air pollutants-Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.	
VI	**Climate change: impacts, adaptation & mitigation:** Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions-past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change. Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and *Intended Nationally Determined Contributions* (INDCs); Climate justice.	**08**
VII	**Environment management:** Introduction to environmental laws and regulation: Constitutional provisions-Article 48A, Article 5lA (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001. Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis. Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management-Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Eco labeling/Eco mark scheme.	**08**
VIII	**Environmental Treaties and Legislation:** An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and non• binding measures; Conference of the Parties (COP). Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access	**08**

	and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgments. Major International organisations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.	

Reference / Text Books:

1. A text book of Ecology and Environment, P.C. Joshi & Namita Joshi, Himalaya Publishing House, Mumbai
2. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
3. Ecology and Environment, H.R. Singh and Neeraj Kumar, Rastogi Publication.
4. Fundamentals of Ecology, E.P. Odum, W.B. Saunders Co., Philadelphia.
5. Essentials of Ecology & Environmental Science, S.V.S. Rana, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Fisher, Michael H. (2018) an Environmental History of India-From Earliest Times to the Twenty-First Century, Cambridge University Press.
7. Wildlife Biology. Rajesh Gopal. Approved By MoEF, New Delhi.

If the course is available as Generic Elective then the students of following departments may opt it.
NO

Prerequisite: Intermediate/Basic knowledge of life science

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	16
2) Presentations /Seminar/Attendance	-
3) Assignments	5

4) Research Project Report Seminar On Research Project Report 5) ESE	4 75
Total:	**100**

Prerequisites for the course: Knowledge of Basics of Environment and Ecology (Intermediate level)

Course Learning Outcomes:

CLO1**:** Student will come up with the knowledge of field Environmental management as well as Sustainable development and benefit of mankind.

CLO2**:** Student will come up with the knowledge of Environment management.

CLO3**:** Student will come up with the knowledge of Environmental Science in cleaning the environment.

CLO4: Student will be Explain sustainable development, its goals, targets, challenges and global strategies for sustainable development.

CLO5: Student will be develop a critical understanding of the environmental issues

CLO6: The overall course outcome focused on the role of Environment management in human welfare.

CLO7: Student will be Explain major conservation strategies taken in India.

CLO8: Student will be able Sensitize themselves to adverse health impacts of pollution.

Instructional Method and Pedagogy

1. Preconditioning of the course and its blueprint shall be discussed in the beginning of the course.
2. Various teaching aids are used for smooth conduction of Lectures.
4. 75% attendance in academic sessions is mandatory.
5. Assignments shall be given at the end of each unit/topic. Extempore activity can also be organized on various topics.
6. PPT presentation method is also incorporated in teaching.
7. Case-study based learning will also be used.
8. Promotion of Ex-situ and In-situ learning.
9. Teaching-learning via organizing seminars, guest lectures, invited talks, symposium etc.
10. Identification of slow and fast learners also done during the course commencement.
11. For Slow learners, there is a provision of arrangements of extra classes/weakened classes/remedial classes for their improvement in academics. .
12. For fast learner students, extra exposure to field visit, guest lectures on advanced topics are incorporated.

PRACTICALS

NHU-NPR-112P: Environment and Ecology Lab

Marks: 50 (35 + 15) **Duration: 30 hours (1 credits)**

Case studies and field work

The students are expected to be engaged in some of the following or similar identified activities:

1. Discussion on one national and one international case study related to the environment and sustainable development.
2. Field visits to identify local/regional environmental issues make observations including data collection and prepare a brief report.
3. Participation in plantation drive and nature camps.
4. Documentation of campus biodiversity.
5. In-situ and Ex-situ Conservation Methods of Biodiversity.

ASSESSMENT FOR PRACTICAL

Internal Assessment	Marks	External Assessment	Marks
Lab Performance/ Filed Work	5	Major Experiment/ Case studies	8

Quiz/ Env. Diary	5	Minor Experiment/ Case studies	6
Charts/ Model	5	Spotting	10
-	-	Viva	6
-	-	Record	5
Total	**15**	**Total**	**35**

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA (CCS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Data Structure and Algorithms using 'C'**
Course Code: 25BCACCS-301	**Title: Data Structure and Algorithms using 'C'**

Course Objectives:

CO1: Remember an introduction of major algorithms and brief description of Array data structures.
CO2: Analyze performance of Linked List algorithms and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue algorithm and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.	8
II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists.	8
III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deque, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal; Traversal of Binary Trees; Application of Binary Trees;	8

	Binary Search Tree (BST), Insertion and Deletion in BST, B-Tree.	
V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Merge Sort, Heap Sort, Linear Search, Binary Search and Hashing.	8

Text Books:

1. Aaron M. Tenenbaum, "Data Structures Using C", Pearson Education.
2. Samir Kumar Bandyopadhyay, K. N. Dey, "Data Structures Using C", Pearson Education.
3. Lipschutz (Schaum's Series), "Data Structure with C", Tata McGraw Hill Education.

Reference

1. Robert Kruse, C. L.Tondo, "Data Structures and Program Design in C" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "Fundamentals of Data Structures", Galgotia Publications.
3. R. S. Salaria, "Data Structures & Algorithms", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology	Evaluation/Assessment Marks
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: ***Problem Solving using 'C'***

Program Learning Outcomes:

PO1: Remember the need of data structure and Algorithms for writing efficient Programs.
PO2: Analyze the performance of linked list algorithms with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structure Algorithm.
PO5:Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Program: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Structure and Algorithms using 'C' Lab**
Course Code: 25BCACCS-301P	**Title: Data Structure and Algorithms using 'C' Lab**

Course Objectives:
CO1: Remember an introduction of major algorithms and brief description of Array data structures.
CO2: Analyze performance of Linked List algorithms and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue algorithm and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	What is an algorithm?	1
2.	Write down difference between Data Type and Data Structure.	1
3.	Differentiate Linear and Non-Linear Data Structure.	1
4.	List operations on Data structure.	1
5.	Explain Complexity.	1
6.	Define Big 'O notation.	1
7.	Define Time space Trade off.	
8.	Declare and Initialize Linear array.	1
9.	Write 4*4 sparse matrix.	1
10.	Write about Linked List.	1
11.	Define Data Structure, its Types and their Brief Explanation.	1
12.	What are the measures of an efficiency of an algorithm? Explain.	1
13.	Explain Linear and multidimensional array with memory implementation in primary memory including concept of row and column major.	1
14.	What do you understand by Insertion and deletion in Linear array, explain their Algorithms.	1
15.	Give a brief overview of Sparse matrix its memory storage, types and examples.	1

16.	What do you understand by complexity of an algorithm? Write down Time and Space complexity and Explain time space trade-off.	1
17.	Write an algorithm for List Creation and Traversal.	1
18.	Explain node deletion algorithms for doubly link list	1
19.	Explain the different types Graph representations?	1
20.	How many passes are required for the elements to be sorted in insertion sort? Explain in detail.	1
21.	What are the two methods of binary tree implementation? Explain them.	1
22.	Write an algorithm for Depth First Search and explain steps of algorithm with suitable example.	1
23.	Explain the situation for collision and overflow area.	1
24.	Write an algorithm for Breapth First Search and explain steps of algorithm with suitable example.	1
25.	Explain the steps of deletion in BST.	1
26.	What is multilevel indexing in terms of tree indexes?	1
27.	What are the two methods of binary tree implementation? Explain them.	1
28.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.	1
29.	Write an algorithm to split a node in a B-Tree.	1
30.	Explain the differences between AVL Tree and BST.	1
31.	Explain the Prims algorithm with suitable example.	1
32.	How many passes are required for the elements to be sorted in quick sort? Explain in detail.	1
33.	Write an algorithm for Bellman Ford and explain some steps with suitable example.	1
34.	Write an algorithm Warshal algorithm and apply the steps of algorithm using suitable example.	1
35.	Explain the Straseen's Algorithm and apply the steps with suitable example.	1
36.	Explain all Greedy Programming approaches.	1
37.	Explain all pair shortest path with an example.	1
38.	Explain Longest Common Sub-Sequence Greedy Programming with an example.	1
39.	Write down the merge sort algorithm and give its worst case, best case and average case analysis.	1
40.	Write down the quick sort algorithm and give its worst case, best case and average case analysis.	1

Reference / Text Books:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25

Total:	**50**

Learning Outcomes:

CO1: Remember the need of data structure and Algorithms for writing efficient Programs.
CO2: Analyze the performance of linked list algorithms with its versatile applications.
CO3: Develop and analyze real time application programs with concept of Stack and Queue.
CO4: Remember the conceptual and practical implementation of Major Tree Data Structure Algorithm.
CO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.PO3: Students can learn Complete Programming Concepts of Arrays.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Operating System**
Course Code: 25BCACCS-302	**Title: Operating System**

Course Objectives:

1. Analyze and evaluate the structure, functions, and types of operating systems, including their components and services.
2. Analyze and evaluate the functioning of processes and process scheduling in operating systems, including process states, context switching, threads, and scheduling algorithms.
3. To Analyze and evaluate process synchronization and deadlock handling techniques.
4. To enable students to understand and analyze memory management techniques including logical and physical address spaces, paging, segmentation, fragmentation, and virtual memory concepts.
5. Apply and analyze the concepts of file systems, disk, and I/O management to design and evaluate efficient storage and input/output subsystems in an operating system.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0
Theory - 1 Hr. = 1 Credit
Credit (4 Hrs./Week = 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Overview of Operating Systems**: Definition of Operating System, Types of Operating Systems-Batch, Time-Sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, OS Operations, OS Services, role of an Operating system as a resource manager, Spooling, System Calls and its types, Kernel, Shell, Device drivers, OS Structures-Layered, Monolithic, Microkernel Operating Systems.	8
II	**Processes:** Definition of Process, processes address space, Principle of Concurrency, Process States, Operations of Processes, Process State Transitions, Process Control Block, Context Switching, processes involved in context switching, Threads and their management, advantages of threads, types of threads, Concept of Multithreads **Process Scheduling:** Scheduling Objectives, Scheduling criteria, Preemptive and Non-Preemptive Scheduling, Types of Schedulers, Difference between Long term and short-term Scheduler, Dispatcher, Scheduling Criteria, Scheduling Algorithms, Multi-processor Scheduling.	8
III	**Process Synchronization:** Mutual exclusion, Critical section, Critical Section Problem, Two Process Solution, Semaphores, Classical Problem of Synchronization- Bounded Buffer Problem, Producer Consumer Problem	8

	and Dinning Philosopher Problem. **Deadlock**: Deadlock Characterizations, Conditions for deadlock, Resource Allocation Graph, Safe state, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Differentiate between deadlock prevention and avoidance, Deadlock Detection, Recovery from Deadlock.	
IV	**Memory Management:** Requirement of memory management, Logical versus Physical Address Space, Swapping, Paging, Fragmentation and its types, Compaction, Segmentation **Virtual Memory:** Virtual Memory and its advantages, Hardware and Control Structures, Demand Paging and its advantages, Page Fault, Page Replacement, Page-Replacement Algorithms, Thrashing, Causes of thrashing.	8
V	**File System**: File, Directory, File attributes, File operations, Types of files, Access Methods, Allocation Methods, File System Structure, Directory Structures and Protection, Free-Space Management. **Disk Management:** Disk Structure, Disk Scheduling Algorithm, Swap-Space Management. **I/O Management:** Principles of I/O Hardware-I/O devices, Types of Devices, Buffering and its types, Pooling, Device Controllers, Interrupt Handlers, Direct Memory Access.	8

Text Books:

1. Silberschatz and Galvin, "*Operating System Concepts*", John Wiley & Sons.
2. "Principles of Operating Systems" Author: Brian L. Stuart
3. "Understanding Operating Systems" Authors: Ann McHoes, Ida M. Flynn
4. "Operating Systems: Internals and Design Principles "Author: William Stallings

Reference

1. Madnick& Donovan, "*Operating Systems*", Tata McGraw Hill.
2. Modern Operating Systems Author: Andrew S. Tanenbaum.
3. Operating Systems: Internal and Design Principles, Author: William Stallings.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Basic knowledge of Operating System and its working.

Course Learning Outcomes:

CO1. Students will be explaining the fundamental concepts, types, operations, and structures of operating systems, and apply this knowledge to identify the role of the OS in managing system resources and processes.

CO2. Students will be able to analyze and apply key operating system concepts related to process management and scheduling, including process states, process control blocks, context switching, thread management, and various scheduling algorithms, to design efficient and concurrent process scheduling systems in multiprocessor environments.

CO3. Students will be able to analyze and apply concepts of process synchronization and deadlock

management, including critical sections, semaphores and deadlock characterization, prevention, avoidance, detection, and recovery techniques, to design and evaluate concurrent systems that ensure safe and efficient resource allocation.

CO4. Students will be able to analyze and evaluate various memory management techniques, including logical and physical address mapping, paging, segmentation, and virtual memory concepts, to effectively manage memory resources and optimize system performance.

CO5. Students **will learn and explain** the structure and management of file systems, disk management techniques, and I/O management principles, including device handling and data transfer methods, to effectively design and optimize operating system components.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Operating System Lab**
Course Code: 25BCACCS-302P	**Title: Operating System Lab**

Course Objectives:
CO1: To Implement the Banker Algorithm using C program
CO2: To implement various Page Replacement Algorithms.
CO3: To implement CPU Scheduling Algorithms and memory management algorithms.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write C programs to implement the FIFO (First-In-First-Out) Page Replacement Algorithm.	2
II	Write C programs to demonstrate Creating a New Process Using fork ().	2
III	Write C programs to implement the SJF CPU Scheduling Algorithms.	2
IV	Write C programs to simulate CPU scheduling algorithms: SJF and Round Robin to calculates waiting time and turnaround time for processes.	2
V	Implement the Contiguous File Allocation Strategies using C programs.	2
VI	Write C programs to simulate solutions to Classical Process Synchronization Problems.	2
VII	Write C programs for the implementation of SCAN disk scheduling algorithm.	2
VIII	Write a C program to implement Bankers Algorithm.	2

Reference / Text Books:
1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7 the edition, Wiley India Private Limited, New Delhi.
2. "Principles of Operating Systems" Author: Brian L. Stuart.
3. "Operating Systems: Internals and Design Principles "Author: William Stallings.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-

5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Identify the performance of various page replacement algorithms.
CO2: Develop banker algorithm for deadlock avoidance.
CO3: Choose the best CPU scheduling algorithm for a given problem instance.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Advance Cloud Security-I**
Course Code: 25BCACCS-303	**Title: Advance Cloud Security-I**

Course Objectives:
CO1: Manage Azure subscriptions, resource groups, RBAC, and governance tools.
CO2: Implement and manage Azure storage solutions with security and data protection.
CO3: Deploy and administer virtual machines and containers using automation and backups.
CO4: Configure virtual networks, secure connectivity, and monitor Azure resources effectively.
CO5: Understand core Azure services, cloud concepts, and identity management with Azure Active Directory.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction to Microsoft Azure Managing Azure Active Directory (users, groups, roles) Implementing Role-Based Access Control (RBAC) Managing subscriptions and resource groups Implementing Azure Policy and Azure Blueprints Using Azure Resource Locks and Tags	10
II	Configuring storage accounts and access keys Managing containers and blobs in Azure Storage Securing storage with shared access signatures (SAS) and Azure AD Implementing Azure Files and Azure File Sync Configuring storage replication and lifecycle management Data protection: soft delete, recovery options	10
III	Deploying and configuring Azure Virtual Machines (Windows & Linux) Automating VM deployment using ARM templates & Bicep Implementing VM backups, snapshots, and availability sets Configuring virtual machine scale sets Managing containers using Azure Container Instances (ACI) and Azure Kubernetes Service (AKS)	10
IV	Configuring virtual networks (VNets) and subnets Setting up IP addressing and DNS Implementing network security groups (NSGs) and application security groups	10

	(ASGs) Setting up Azure Firewall, DDoS protection, and Bastion Configuring virtual network peering and VPN Gateways Implementing ExpressRoute and private endpoints	
V	Monitoring resources using Azure Monitor and Log Analytics Setting up alerts, diagnostics, and action groups Backing up Azure VMs and workloads using Azure Backup Implementing Azure Site Recovery (ASR) for disaster recovery Viewing and analyzing performance metrics and health status	10

Text Books:

1. Azure Administrator Associate, **Author:** Harshul Patel, **Publisher:** Microsoft Press
2. Microsoft Azure Administrator, **Author:** Sjoukje Zaal, **Publisher:** Packt Publishing

Reference:

1. AZ-104 Microsoft Azure Administrator, Author: Harshul Patel, Microsoft Press

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain core Azure services, cloud concepts, and Azure Active Directory functionality.
CO2: Manage Azure subscriptions, resource groups, and implement RBAC and policies.
CO3: Configure and secure storage accounts, blob services, and file shares.
CO4: Deploy and administer virtual machines, containers, and manage availability and backups.
CO5: Implement virtual networking, secure access with firewalls and VPNs, and monitor Azure infrastructure.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Advance Cloud Security-I Lab**
Course Code: 25BCACCS-303P	**Title: Advance Cloud Security-I Lab**

Course Objectives:
To learn the student should be made to:
CO1: Learn to use Hadoop
CO2: Learn to run virtual machines of different configuration.
CO3: Be exposed to tool kits for cloud environment.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Install Virtual box/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.	2
II	Install a C compiler in the virtual machine created using virtual box and execute Simple Program.	2
III	Create hello world app and other simple web applications using python/java.	2
IV	Find a procedure to transfer the files from one virtual machine to another virtual machine.	2
V	Find a procedure to launch virtual machine using try stack.	2
VI	Install Hadoop single node cluster and run simple applications like word count.	2
VII	Prepare appt on cloud computing–introduction, models, services ,and architecture	2
VIII	Create your resume in a neat format using google.	2

Reference / Text Books:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-

5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Design and Implement applications on the Cloud.
CO2: Use the cloud tool kits.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Blockchain**
Course Code: 25BCACCS-304-1	**Title: Blockchain**

Course Objectives:
CO1: Study and understand basic concepts of Blockchain basics.
CO2: Learn about various consensus protocol used in Blockchain.
CO3: Evaluate and learn about cryptocurrency.
CO4: Learn about various security features of Blockchain.
CO5: Evaluate Blockchain Technology used in different areas.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction of Blockchain**: Foundation of Blockchain, Features of Blockchain, Need of Blockchain, Component of Blockchain, Public blockchains, Permissioned blockchains, Private blockchains, *The* Structure of Blockchains, The Blockchain Life Cycle, Blockchain architecture, Blockchain-as-a-Service.	8
II	**Consensus Algorithm:** Introduction of Consensus, Proof of Work (PoW), Proof of State (PoS), Proof of Authority (PoA) Hash functions, Merkle Tree, Nonce in Blockchain.	8
III	**Cryptocurrency:** Blockchain version; Currency, Smart Contracts, Dapps, History of the Bitcoin Blockchain, History of the Ethereum Blockchain, History of the Ripple Blockchain, Myth about Cryptocurrency.	8
IV	**Privacy And Security Techniques Used in Blockchain:** Hyperledger, Cryptography in Blockchain: Symmetric Cryptography, Asymmetric Cryptography, Cryptographic Hash, how security differs by blockchain types? Keys in Cryptography.	8
V	**Blockchain Uses:** Financial Services, Medical and healthcare, Blockchain city, Education Services.	8

Text Books:
1. Mark Gates, "Blockchain-Ultimate Guide to Understand blockchain," Wise Fox Publishing.
2. Vikram Dhillon, David Metcalf, Max Hooper "**Blockchain Enabled Applications**" A press.

Reference
1. Tiana Laurence,"Blockchain For Dummies,", John Wiley & Sons, Inc.

2. Melanie Swa, "Blockchain", O' Reilley.	
Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**
Course Learning Outcomes:	
CO1: Explain how a blockchain records and verifies transactions. CO2: Contribute to the development of new blockchain protocols or standards. CO3: Simulate crypto currency transactions on a test network. CO4: Able to explain about Hyper ledger used in Blockchain technology. CO5: Compare and contrast different blockchain platforms and their suitability for specific applications.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme : Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Course : Data Mining & Data Warehousing**
Course Code: 25BCACCS-304-2	**Title: Data Mining & Data Warehousing**

Course Objectives:
CO1: To Understand data warehousing components, architecture, and OLAP concepts.
CO2: To Comprehend data mining fundamentals, functionalities, and major issues.
CO3: To Explore classification, prediction, and association rule mining algorithms
CO4: To Learn various clustering methods including partitioning, hierarchical, and density-based approaches.
CO5: To Understand mining of complex data objects, spatial, multimedia, text, and web data.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Data Warehousing** Overview and Concepts: Data Warehousing Components, Building a Data Warehouse, Data Warehouse Architecture, Data Extraction, Cleanup, and Transformation Tools, Metadata, Reporting, Query tools and Applications, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.	8
II	**Data Mining** Introduction: Fundamentals of Data Mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Major issues in Data Mining. Data Pre-processing, Need for Pre-processing the Data, Data Cleaning, Data Integration & Transformation, Data Reduction, Decentralization and Concept Hierarchy Generation	8
III	**Data Mining Techniques** Classification and Prediction: - Issues Regarding Classification and Prediction, Classification by Decision Tree, Bayesian Classification, Rule Based Classification, Association Rule Mining, Efficient and Scalable Frequent Itemset Mining Methods, Market Basket Analysis, Apriori Algorithm, Tree Based Algorithms, Prediction – Regression Models, Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor	8
IV	**Cluster Analysis** Clustering Overview, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Partitioning Clustering-K-Means	8

	Algorithm; Basic Agglomerative Hierarchical Clustering Algorithm, Key Issues in Hierarchical Clustering, Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods- Neural Network Approach, Outlier Analysis.	
V	**Mining Object, Spatial, Multimedia, Text and Web Data:** Mining the World Wide Web, Multimedia Data Mining, Text Mining, Web Content Mining, Web Structure Mining, Web Usage Mining Data Analysis and Visualization: Correlation, Covariance, Rank and Percentile.	8

Text Books:

1. Jiawei Han, Jian Pei, Micheline Kamber, *"Data Mining: Concepts and Techniques"*, Elsevier.
2. Margaret H. Dunham, "*Data Mining: Introductory and Advanced Topics",* Pearson Education.
3. Arun K. Pujari, *"Data Mining Techniques"*, Universities Press.
4. Pieter Adriaans & Dolf Zantinge, *"Data Mining"*, Pearson Education.

Reference

1. "Introduction to Data Mining" by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar.
2. "*Data* Warehousing, Data Mining, and OLAP" by Alex Berson and Stephen Smith.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Student is able to design data warehouse schemas and apply OLAP techniques for data analysis.
CO2: Student is able to perform data pre-processing steps like cleaning, integration, and reduction
CO3: Student is able to apply decision trees, Bayesian classification, and Apriori algorithm to real-world problems
CO4: Student is able to implement K-Means, hierarchical clustering, and DBSCAN algorithms.
CO5: Student is able to analyze and visualize data using advanced charts and reporting tools.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 2 **Theory: 2** **Practical: 0**	**Course: Basics of SQL**
Course Code: 25BCACCS-305	**Title: Basics of SQL**
Course Objectives:	
CO1: Understand the fundamentals of databases and SQL CO2: Develop foundational skills in SQL data manipulation and retrieval CO3: Apply SQL functions and filtering techniques for effective data processing CO4: Understand and implement to Execute complex queries using joins, sub queries, and set operations CO5: Implement database integrity, views, transactions, and stored procedures	
Nature of Paper: SEC	
Minimum Passing Marks/Credits: 40% Marks / 2 Credits (Internal +ESE)	
L: 2 T: 0 P: 0 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1Credit (4 Hrs./Week=4 Credits)	

Unit	Contents	No. of Lectures Allotted
I	Introduction to Databases & SQL Basics Overview of Databases & DBMS Introduction to SQL (Structured Query Language) Types of SQL commands: DDL, DML, DCL, TCL Basic SQL syntax and conventions Creating and managing databases Creating tables (`CREATE`, `ALTER`, `DROP`) Data types in SQL Inserting, updating, and deleting data (`INSERT`, `UPDATE`, `DELETE`) Retrieving data (`SELECT`, `WHERE`, `ORDER BY`, `DISTINCT`)	6
II	Filtering, Functions, and Data Operations SQL Operators: Arithmetic, Comparison, Logical (`AND`, `OR`, `NOT`) Pattern matching with `LIKE` and wildcards NULL values and handling them (`IS NULL`, `IS NOT NULL`) Built-in SQL functions: String functions (`CONCAT`, `SUBSTRING`, `TRIM`) Numeric functions (`ROUND`, `ABS`, `CEIL`, `FLOOR`) Date/Time functions (`NOW`, `DATE`, `MONTH`, `YEAR`) Aggregate functions (`SUM`, `AVG`, `MIN`, `MAX`, `COUNT`) Grouping data with `GROUP BY` and filtering with `HAVING`	6
III	Joins, Sub queries, and Advanced Retrieval	6

	INNER JOIN, LEFT JOIN, RIGHT JOIN, * FULL JOIN, CROSS JOIN, Self-joins Nested queries / Sub queries	
IV	Constraints, Indexes, and Views Integrity constraints: PRIMARY KEY, FOREIGN KEY, UNIQUE , NOT NULL, CHECK Indexes: creation and usage Views: Creating views (`CREATE VIEW`) Updating through views Dropping views	6
V	Transactions, Security, and Stored Routines `COMMIT`, `ROLLBACK`, `SAVEPOINT` Transaction properties (ACID) User management and permissions (`GRANT`, `REVOKE`) Stored Procedures: creation, execution, parameters	6

Text Books:

1. SQL, PL/SQL – The Programming Language of Oracle by Ivan Bayross BPB Publication.
2. SQL For Dummies" Author: Allen G. Taylor (Wiley Publishing).
3. "SQL: The Complete Reference" James R. Groff, Paul N. Weinberg McGraw-Hill Education.

Reference

1. SQL for Data Analysis: Advanced Techniques for Transforming Data into Insights by Cathy Tanimura O REILLY
2. "SQL Cookbook" Anthony Molinaro O'Reilly Media

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Describe the fundamental concepts of databases and relational DBMS
CO2: Create and manipulate relational database objects using SQL.
CO3: Student shall be able to retrieve and process data using SQL queries and built-in functions
CO4: Explain advanced data retrieval using joins, sub queries, and set operations
CO5: Explain data integrity, manage transactions, and implement stored routines

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Basics of SQL Lab**
Course Code: 25BCACCS-305P	**Title: Basics of SQL Lab**

Course Objectives:
To learn the student should be made to:
CO1: Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
CO2: Be familiarized with a query language
CO3: Have hands on experience on DDL Commands
CO4: Have a good understanding of DML Commands and DCL commands
CO5: Familiarize advanced SQL queries and exposed to different applications

Nature of Paper: SEC

Minimum Passing Marks/Credits: 50% Mark / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit(4 Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction to SQL and Databases, Select and use a database, View all tables in a database..	2
II	Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.	2
III	**Perform the following:** a. Viewing all databases, creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting b. Manage records in a table, save changes using `COMMIT`, and revert changes using `ROLLBACK`."	2
IV	**Perform the following:** a. Altering a Table, Dropping/Truncating/Renaming Tables	2
V	For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer Join Subqueries-With IN clause, With EXISTS clause.	2
VI	**For a given set of relation tables perform the following** a. Creating Views (with and without check option), Dropping views,	2

	Selecting from view.	
VII	Sorting and Filtering:- Use `ORDER BY` for sorting results , Use `DISTINCT` to remove duplicates, Use `BETWEEN`, `IN`, and `LIKE` for filtering.	2
VIII	Given the table EMPLOYEE (Emp. No, Name, Salary, Designation, Dept. ID) write a cursor to select the five highest paid employees from the table.	2

Reference / Text Books:

1. Fundamentals of Database System By Elmasari & Navathe, 7th Edition, 2018, Pearson Education.
2. Database System Concepts by Silberschatz, Korth& Sudarshan, 6th Edition, 2019, McGraw-Hill Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Design and implement a database schema for a given problem-domain.

CO2: Populate and query a database also modify the database schema.

CO3: Create and maintain tables using PL/SQL and also handle the cursors.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Cyber Security**
Course Code: 25BCACCS-306	**Title: Cyber Security**

Course Objectives: Upon successful completion of this course, students will be able to:

CO1: Understand the foundational concepts of cyberspace and the internet's architecture.
CO2: Identify and analyze various forms of cybercrime and the legal frameworks designed to combat them.
CO3: Recognize security threats associated with social media and apply best practices for safe online interaction.
CO4: Comprehend the security aspects of e-commerce and digital payment systems, including common frauds and preventive measures.
CO5: Implement essential security measures for digital devices and utilize basic cybersecurity tools and technologies.

Nature of Paper: VAC

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory-1 Hr.=1Credit
Practical-2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	8
II	Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.	8
III	Social Media Overview and Security: Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws, regarding	8

	posting of inappropriate content, best practices for the use of social media, Case studies.	
IV	E–Commerce and Digital Payments: Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act, 2007,	8
V	Digital Devices Security, Tools and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	8

Text Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
2. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
3. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
5. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

Reference:

1. Fundamentals of Network Security by E. Maiwald, McGraw Hill..
2. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: After completion of this module, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2: Students, at the end of this module, should be able to understand the cyber-crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

CO4: After the completion of this module, students would be able to understand the basic concepts

related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

CO5: Students, after completion of this module will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: OOPs Using Java**
Course Code: 25BCACCS-401	**Title: OOPs Using Java**

Course Objectives:
CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of abstraction.
CO4: Able to understand the use of Packages and Interface in java.
CO5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to OOPs and Java:** OOPs Concepts, Top-Down Approach and Bottom Up Approach, Introduction to Java, History of Java, Features of Java, Byte Code, JVM, JRE, JDK, JIT, Java Applications, Character Set, Identifiers, Literals, Comments, Keyword, Data Type, Operators, Conditional Statements, Looping Statements, Array Declaration, Creation, Initialization. **String Handling:** Predefined Functions in String, String Methods, Command-Line Arguments.	8
II	**Classes, Objects and Methods:** Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors, Types of Constructors, this, super & static keyword, Inheritance, Types of Inheritance, Method Over Loading & Overriding, final keyword, Abstract Class.	8
III	**Interfaces and Packages:** Defining Interfaces, Extending and Implementing Interfaces, Defining Packages, Access Protection, Importing Packages, **Exception Handling:** Exception Types, Multiple Catch Clauses, Nested Try Statements, Throw, Throws, Finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.	8
IV	**Multithreaded Programming:** Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority, Runnable interface. **Managing I/O Files:** Introduction, Streams, Stream Classes, File Class, Creation of Files, Reading and Writing to File.	8
V	**GUI Programming and Event Handling:** AWT, Swing, Layout Managers:	8

	Flow Layout, Border Layout, Grid Layout, GUI components like J Buttons, JCheck Boxes, JRadio Buttons, J Labels, J Text Fields, J Text Areas, J Combo Boxes, Sliders, Windows, Menus, Dialog Box, Event handling in java, Event types, Mouse and key events. **Connecting to Database:** JDBC Type 1 to 4 drivers, Connecting to a database, querying a database and processing the results, updating data with JDBC.	

Text Books:

1. Patrick Naughton and Herbertz Schildt, "Java-2 The Complete Reference", McGraw Hill.
2. Ivor Horton, "Beginning Java-2", Wiley Publishing.
3. Balaguruswamy, "Programming with Java: A Primer", Tata McGraw Hill Education.

Reference:

1. Horetmann Cay and Cornell Gary, "Core Java Volume – I", Pearson Education.
2. Horetmann Cay and Cornell Gary, "Core JavaTM 2, Volume II – Advanced Features", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of abstraction.
CO4: Able to understand the use of Packages and Interface in java.
CO5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: OOPs using Java Lab**
Course Code: 25BCACCS-401P	**Title: OOPs using Java Lab**

Course Objectives:
CO1: Understand and apply the fundamental concepts of Object-Oriented Programming using Java.
CO2: Solve real-world problems using Java classes, objects, inheritance, and polymorphism.
CO3: Apply abstraction, interfaces, and packages to develop modular programs.
CO4: Implement robust Java applications using exception handling and multithreading.
CO5: Create GUI-based applications and perform file/database operations using Java I/O and JDBC.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction, Basic Syntax, and Control Structures:** 1. Write a Java program to display "Hello, World!" using command-line arguments. 2. Develop a Java program for simple arithmetic operations using control statements. 3. Implement a Java program to demonstrate usage of loops (for, while, do-while). 4. Write a Java program to check whether a string is a palindrome using String methods.	3
II	**Introduction, Basic Syntax, and Control Structures:** 1. Write a Java program to use ***static and super*** keyword. 2. Implement a Java program to demonstrate usage of **constructor.** 3. Implement a Java program to demonstrate usage of **abstract classes.** 4. Implement a Java program to demonstrate usage of **Inheritance**	3
III	**Interfaces, Packages, and Exception Handling:** 1. Write a program to create and use user-defined packages. 2. Develop an application using interfaces and multiple inheritance. 3. Create a program demonstrating try, catch, finally, throw, and throws. 4. Develop a custom exception class and use it in a program to handle user-defined exceptions.	3
IV	**Multithreading and File I/O:** 1. Write a program to create threads using Thread class and Runnable	3

	interface. 2. Implement thread synchronization using synchronized methods. 3. Write a Java program to create and write to a file using FileOutputStream. 4. Develop a program to read content from a file and display it using Buffered Reader.	
V	**GUI Programming and Database Connectivity:** 1. Create a simple GUI form using Swing components such as J Button, J Label, J Text Field, etc. 2. Write a Java program using Swing to build a calculator application. 3. Develop a program to connect to a MySQL database using JDBC and retrieve data. 4. Implement insert, update, delete operations in a database using JDBC.	3

Text Books /Reference:

1. Patrick Naughton and Herbertz Schildt, "Java-2: The Complete Reference", McGraw Hill.
2. E. Balaguruswamy, "Programming with Java: A Primer", Tata McGraw Hill Education.
3. Cay S. Horstmann & Gary Cornell, Core Java Volume I & II, Pearson Education.
4. Ivor Horton, *Beginning Java 2*, Wiley Publishing.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Develop and test Java programs using object-oriented features like classes, objects, and constructors.

CO2: Implement inheritance, method overloading/overriding, and abstraction.

CO3: Apply interfaces, packages, and exception handling mechanisms in Java programs.

CO4: Develop multithreaded applications and perform file I/O operations in Java.

CO5: Design GUI-based applications with AWT/Swing and integrate database operations using JDBC.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Software Engineering**
Course Code: 25BCACCS402	**Title: Software Engineering**

Course Objectives:

CO1: Introduce and apply various software development process models, enabling students to select the most appropriate model based on project needs.
CO2: Develop the ability to gather, analyze, and document software requirements for different kinds of software systems using industry standards.
CO3: Impart foundational knowledge of software architecture and design principles.
CO4: Familiarize students with essential concepts in software project management, including cost estimation, scheduling, and progress tracking.
CO5: Equip students with practical knowledge of software testing and debugging techniques, and the ability to assess their effectiveness in real-world scenarios.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction: Software- Characteristics and Applications, Software Engineering, Software Engineering Layers, Software Process Framework, CMM, Software Quality Attribute and Metrics, Software Development Life Cycle, Software Process Models Water Fall Model, Prototyping Model, RAD Model, Spiral Model, Evolutionary Models, Component-based Development Model.	8
II	Software Requirements Engineering and Analysis Modeling: Software Requirements, Requirement Engineering Process, Elicitation Requirements, Analysis and Negotiating Requirements, Requirement Specification, System Modeling, Requirements Validation, Requirement Management, Creating a Software Requirements Specification Document, IEEE Standards for SRS, Feasibility Study, Elements of Analysis Model, Data Modeling- ER Diagram, Information Modeling-DFD, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.	8
III	Software Design and Implementation: Design Process, Principles, and Design Concepts-Abstraction, Architecture, Refinement, Modularity, Data Structure, Information Hiding, Functional Independence, Cohesion, Coupling; Design Documentation, Design Strategies-Top Down and Bottom Up Design; Design Model Data Design Elements, Architectural Design, User Interface Design,	8

	Component-Level Design, Deployment-Level Design, Implementation Issues and Programming Support Environment.	
IV	Software Testing: Verification, Validation, Testing Objectives, Unit Testing, Integration Testing, Validation Testing, System Testing, Acceptance Testing, Regression Testing, Test Characteristics, White Box Testing, Basic Path Testing, Control Structure Testing, Black Box Testing, Test Plan, Test Case Design, Quality Metrics for Testing.	8
V	Software Maintenance: Nature and Need of Maintenance, Types of Maintenance (Perceptive, Preventive, Adoptive, Corrective), Cost of Maintenance, Evolution of Software, Software Maintenance Process, Software Maintenance Techniques-Reverse Engineering, Reengineering; Factors affecting Software Maintenance, Key Issues in Maintenance, Software Configuration Management, Version and Release Control, Change Control.	8

Text Books:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", Addison Wesley
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer

Reference:

1. K. K. Aggarwal & Yogesh Singh "Software Engineering", New Age International.
2. I. Sommerville, "Software Engineering", Pearson Education.
3. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
4. Subramanian Chandramouli, Saikat Dutt, Chandramouli Seetharaman, B. G Geetha, "Software Engineering", Pearson Education India

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Differentiate between various software process models and justify their use in real-life software projects.
CO2: Construct data flow diagrams (DFDs), entity-relationship diagrams (ERDs), and other models to represent software requirements effectively.
CO3: Create design models including architectural, data, and user interface designs for software systems.
CO4: Design effective test plans and test cases and evaluate testing outcomes using quality metrics.
CO5: Apply maintenance techniques such as reverse engineering and reengineering in evolving software systems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Software Engineering Lab**
Course Code: 25BCACCS-402P	**Title: Software Engineering Lab**

Course Objectives:
CO1: Solve different types of case diagram.
CO2: Apply white box and black box testing.
CO3: Solve state diagram and activity diagram.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Draw the use case diagram and specify the role of each of the actors. Also state the precondition, post condition and function of each use case	2
II	Preparation of Software Requirement Specification Document and Design Documents.	2
III	Identify the classes. Classify them as weak and strong classes and draw the class diagram.	2
IV	Preparation of Software Configuration Management and Risk Management related documents	2
V	Study and usage of any Design phase CASE tool.	2
VI	Prepare a SRS document in line with the IEEE recommended standards.	2
VII	Develop test cases for unit testing and integration testing.	2
VIII	Develop test cases for various white box and black box testing techniques.	2
IX	Draw the activity diagram	2
X	Draw the state chart diagram.	

Text Books:
- RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
- Pankaj Jalote, Software Engineering, Wiley

Reference Books
- Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
- K.K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report	-
Seminar On Research Project Report	
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Able to solve different types of case diagram.
CO2: Able to apply white box and black box testing on SRS.
CO3: Evaluate state diagram and activity diagram.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA (CCS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Advance Cloud Security-II**
Course Code: 25BCACCS-403	**Title: Advance Cloud Security-II**

Course Objectives:
CO1: To understand basics of cloud computing security including different architecture service models.
CO2: To learn different solutions of security issue.
CO3: To analyse different security services available in cloud for different purposes and applications.
CO4: To understand different security solutions and applications available on AWS.
CO5: To learn design different methods to provide backup solutions for cloud data.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Ethical Hacking:** Key issues plaguing the information security world, incident management process, and penetration testing. **Foot printing and Reconnaissance:** Various types of foot printing, foot printing tools, and countermeasures. **Scanning Networks:** Network scanning techniques and scanning countermeasures. **Enumeration:** Enumeration techniques and enumeration countermeasures.	8
II	**Vulnerability Analysis:** Vulnerability Analysis using different tools **System Hacking:** System hacking methodology, steganography, steganalysis attacks, and converting tracks. **Malware Threats:** Different types of Trojans, Trojan analysis, and Trojan Countermeasures, Working of viruses, virus analysis, computer worms, malware analysis procedure, and countermeasures.	8
III	**Sniffing:** Packet sniffing techniques and how to defend against sniffing **Social Engineering:** Social Engineering techniques, identify theft, and social engineering countermeasures. **Denial-of-Service:** DoS/DDoS attack techniques, botnets, DDoS attack tools, and DoS/DDoS countermeasures. **Session Hijacking:** Session hijacking techniques and countermeasures.	8
IV	**SQL Injection:** SQL injection attacks and injection detection tools. **Hacking Wireless Networks:** Wireless Encryption, wireless hacking	8

	methodology, wireless hacking tools, and Wi-Fi security tools. **Hacking Mobile Platforms:** Mobile platform attack vector, android vulnerabilities, jail breaking iOS, windows phone 8 vulnerabilities, mobile security guidelines, and tools.	
V	**Evading IDS, Firewalls and Honey pots:** Firewall, IDS and honey pot evasion techniques, evasion tools, and Countermeasures **Cloud Computing:** Various cloud computing concepts, threats, attacks, and security techniques and tools. **Cryptography:** Different types of cryptography ciphers, Public Key Infrastructure (PKI), cryptography attacks, and cryptanalysis tools.	8

Text Books:

1. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier) - 978-1-59749-592-9
2. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, and Amin Naserpour, Prentice Hall.

Reference

1. Samani, Raj; Reavis, Jim; Honan, Brian. CSA Guide to Cloud Computing: Implementing Cloud Privacy and Security, 1 edition ed. Syngress, 2014.
2. AWS Cloud Security Resources https://aws.amazon.com/security/security-resources.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Identify different services and deployment models used for implementation of cloud computing.
CO2: Able to Compare and contrast different solutions available for virtualization.
CO3: Able to analyze different cloud services and techniques required to work on cloud for application.
CO4: Able to select different existing solutions and methods to work on AWS.
CO5: Able to design & develop backup strategies for cloud data based on features.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Advance Cloud Security-II Lab**
Course Code: 25BCACCS-403P	**Title: Advance Cloud Security-II Lab**

Course Objectives:
To learn the student should be made to:
CO1: Understand the limitations imposed by data privacy laws.
CO2: To learn threats and risks within context of the cyber security
CO3: To have an overview of the cyber laws & concepts of cyber forensics

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=2 Credits)

Unit	Contents	No. of Lectures Allotted
1	Study the use of network reconnaissance tools like WHOIS, dig, trace route, lookup to gather information about networks and domain registrars	2
2	Implement a code to simulate buffer overflow attack.	2
3	Download and install map. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, etc.	2
4	Detect ARP spoofing using open-source tool ARPWATCH.	2
5	Use the Nessus tool to scan the network for vulnerabilities.	2
6	Set up IPSEC under LINUX	2
7	Mini project	2

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar on Research Project Report	-
5) ESE	25
Total:	50

Course Learning Outcomes:
Student will be able to:
CO1: Discover software bugs that pose cyber security threats.
CO2: Discover cyber-attack scenarios to web browsers and web servers.
CO3: Discover well known cyber-attack incidents

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: IOT**
Course Code: 25BCACCS-404-1	**Title: IOT**

Course Objectives:

CO1: To analyze the conceptual framework, architectural components, and technological foundations of IoT and M2M communication systems, enabling students to evaluate their applications and design principles for connected devices.

CO2: Analyze and evaluate various hardware components and embedded platforms used in IoT systems, including sensors, actuators, RFID technology, and wireless sensor networks, to understand their roles and applications in real-world IoT environments.

CO3: Evaluate various wireless medium access and routing protocols used in IoT networks, and analyze strategies for sensor deployment, node discovery, and efficient data aggregation to optimize network performance.

CO4: Enable students to apply foundational programming concepts to configure and operate Arduino boards for real-world IoT applications using the Arduino IDE and relevant libraries.

CO5: Help students understand the key design, development, and security challenges in IoT systems, along with the diverse applications ranging from smart metering to smart city infrastructure.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (3Hrs./Week=3Credits)

Unit	Contents	No. of Lectures Allotted
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability.	8
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Net Arduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	8
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment	8

	& Node discovery, Data aggregation & dissemination.	
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	8
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	8

Text Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014.
6. Adrian Mc Ewen, Hakin Cassimally "Designing the Internet of Things" Wiley India.

Reference "Internet of Things:

1. **A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti at** Universities Press (2014)
2. **"Internet of Things: Principles and Paradigms" by** Rajkumar Buyya, Amir Vahid Dastjerdi *Publisher:* Morgan Kaufmann
3. **"Building Internet of Things with the Arduino" by** Charalampos Doukas *Publisher:* Packt Publishing
4. **"Internet of Things: Architecture and Design Principles" by** Rajkumar Buyya, Satish Narayana Srirama *Publisher:* Wiley (2020)

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/ Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	10
4. Research Project Report Seminar On Research Project Report	-
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: By the end of the course, students will be able to design IoT/M2M systems by applying standardized communication technologies and data enrichment strategies to create affordable and efficient

CO2: By the end of the course, students will be able to design and implement basic IoT solutions using embedded platforms such as Arduino and Raspberry Pi, integrating sensors, actuators, and wireless communication modules to solve practical problems.

CO3: Students will be able to compare and select appropriate MAC and routing protocols for specific IoT scenarios, and implement node deployment and data dissemination techniques to enhance communication efficiency within sensor networks.

CO4: By the end of this course, learners will be able to analyze and troubleshoot Arduino-based IoT systems by interpreting code behavior through emulators and physical board testing.

CO5: By the end of the course, students will be able to evaluate IoT application designs—such as smart street lighting or home automation—by identifying potential technical and security challenges and proposing viable solutions.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Computer Based Numerical and Statistical Techniques**
Course Code: 25BCACCS-404-2	**Title: Computer Based Numerical and Statistical Techniques**

Course Objectives:
CO1: Students will learn to find roots of algebraic and transcendental equations
CO2: Student will explore techniques like Newton's forward/backward interpolation
CO3: learn to approximate derivatives and integrals using numerical methods
CO4: Students will be introduced to various methods for solving ordinary differential equations
CO5: Students will gain skills in hypothesis testing and using statistical techniques for analyzing data.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)

Unit	Contents	No. of Lectures Allotted
I	Numbers and their accuracy, Computer Arithmetic, Mathematical preliminaries, Errors and their Computation, General error formula, Error in a series approximation Solution of Algebraic and Transcendental Equation: Bisection Method, Iteration method, Method of false position, Newton-Raphson method, Methods of finding complex roots, Muller's method, Rate of convergence of Iterative methods, Polynomial Equations.	8
II	Finite Differences, Difference tables Polynomial Interpolation: Newton's forward and backward formula Central Difference Formulae: Gauss forward and backward formula, Stirling's, Bessel's, Everett's formula. Interpolation with unequal intervals: Langrange's Interpolation, Newton Divided difference formula, Hermite's Interpolation,	8
III	Numerical Integration and Differentiation: Introduction, Numerical differentiation Numerical Integration: Trapezoidal rule, Simpson's 1/3 and 3/8 rule, Boole's rule, Waddle's rule	8
IV	Solution of differential Equations: Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta Methods, Predictor Corrector Methods, Automatic Error Monitoring and Stability of solution	8
V	Statistical Computation: Frequency chart, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves etc, Data fitting with Cubic splines, Regression Analysis, Linear and Non-linear Regression, Multiple regression, Statistical Quality Control methods.	8

Text Books:
1. T Veerarajan, T Ramachandran, "Theory and Problems in Numerical Methods, TMH.

<table>
<tr><td colspan="2">Reference
1. Rajaraman V, “Computer Oriented Numerical Methods”, Pearson Education
2. Jain, Iyengar and Jain, “Numerical Methods for Scientific and Engineering Computations”, New Age Int.</td></tr>
<tr><td colspan="2">Evaluation/Assessment Methodology</td></tr>
<tr><td></td><td>Max. Marks 100</td></tr>
<tr><td>1) Class tasks/ Sessional Examination
2) Presentations /Seminar
3) Assignments
4) Research Project Report
Seminar On Research Project Report
5) ESE</td><td>15
-
-
10

75</td></tr>
<tr><td>Total:</td><td>100</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Prerequisites for the course: NIL</td></tr>
<tr><td colspan="2">Course Learning Outcomes:
CO 1: Able to find roots of algebraic and transcendental equations
CO 2: Able to solve techniques like Newton's forward/backward interpolation
CO 3: Able to Evaluate approximate derivatives and integrals using numerical methods
CO 4: Able to solve differential equations.
CO 5: Understand basic concept of statistics and analyze data</td></tr>
</table>

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programmed: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Introduction to Machine Learning**
Course Code: 25BCACCS-404-3	**Title: Introduction to Machine Learning**

Course Objectives:

CO1: Understand the core principles of machine learning, including supervised, unsupervised, and reinforcement learning.
CO2: To gain proficiency in using Python libraries essential for data science, such as NumPy, Pandas, and Matplotlib.
CO3: Learn and implement various regression and classification algorithms.
CO4: Learn master techniques for data preprocessing, feature selection, and model evaluation to build robust ML models.
CO5: Evaluate hands-on experience by applying machine learning algorithms to real-world and standard datasets.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Foundations of Machine Learning: Introduction to Machine Learning (ML), key terminology, and the learning process. Types of ML: Supervised, Unsupervised, Semi-supervised, and Reinforcement Learning. Role of ML in data science and big data. Datasets for ML: sources, types (training, validation, testing), and characteristics. Real-world applications and societal impact.	**8**
II	Data Science Toolkit in Python • **NumPy:** Introduction to numerical computing, creating and indexing NumPy arrays, data types, and array mathematics (transformations, reshaping, broadcasting). • **Pandas:** Introduction to Series and DataFrames. Data loading, viewing, and selection (loc, iloc). Handling missing data, basic statistical operations, and applying functions.	**8**
III	Regression and Classification Models • **Regression:** Simple Linear Regression, Ordinary Least Squares (OLS). Introduction to Scikit-learn. Implementing Linear Regression with Scikit-learn on toy datasets. Model Evaluation Metrics: Mean Absolute Error (MAE), Mean Squared Error (MSE), and R-squared (R2) score..	**8**

	• **Classification:** Introduction to classification problems. Logistic Regression. Model Evaluation Metrics: Accuracy, Confusion Matrix.	
IV	Data Preprocessing and Model Tuning • **Data Scaling:** Standardization (Standard Scaler) and Normalization (Min Max Scaler, l1, l2 norms). • **Handling Missing Data:** Imputation strategies for numerical and categorical data. • **Feature Selection:** Understanding feature importance. Filter methods: Correlation, Chi-squared (X2) test, F-score, and Mutual Information.	**8**
V	Advanced Supervised Learning Algorithms • **Decision Trees:** Classification and Regression Trees (CART) algorithm. • **Instance-Based Learning:** k-Nearest Neighbors (k-NN) algorithm. • **Support Vector Machines (SVM):** Maximal margin classifier, support vectors, and the use of kernels (linear, polynomial, RBF).	**8**

Text Books:

1. Géron, A. (2022). *Hands-On Machine Learning with Scikit-Learn, Keras & Tensor Flow* (3rd ed.). O'Reilly Media.
2. Müller, A. C., & Guido, S. (2016). *Introduction to Machine Learning with Python: A Guide for Data Scientists*. O'Reilly Media.

Referential Books

1. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. Springer.
2. Bishop, C. M. (2006). *Pattern Recognition and Machine Learning*. Springer.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Artificial Intelligence

Course Learning Outcomes:

CO1: Able to Explain the fundamental concepts of machine learning and its real-world applications.
CO2: Able to Perform data manipulation, cleaning, and visualization using Python's data science stack.
CO3: Implement and evaluate linear and logistic regression models using Scikit-learn.
CO4: Apply various data pre-processing techniques to prepare data for machine learning models.
CO5: Build and compare different supervised learning models like Decision Trees, SVMs, k-NN, and Ensemble methods.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical; 0**	**Course: Introduction to Artificial Intelligence**
Course Code: 25BCACCS-404-4	**Title: Introduction to Artificial Intelligence**

Course Objectives:

CO1: To understand about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: To study the concepts Propositional logics, predicate Logic.
CO3: To understand the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts.
CO4: To understand concepts of Prolog and Implement the Prolog Program.
CO5: To learning concepts of Expert system and Learning.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.= 1 Credit (4 Hrs./Week= 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).	**8**
II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, No deductive Inference Methods, Rules.	**8**
III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts	**8**
IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/output and Streams, Databases, Implementation of Concepts in Prolog.	**8**
V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition, Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice,	**8**

	Learning in Problem Solving, Learning from Example-Induction, Explanation Based learning.	

Text Books:

1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. Dan W. Patterson, *"Introduction to Artificial Intelligence & Expert Systems"*, PHI.
2. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.

Referential Books:

1. Stuart J. Russell &Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall.
2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: mathematics, statistics, and Computer programming.

Course Learning Outcomes:

CO1: Learnt about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: Learnt study the concepts Propositional logics, predicate Logic
CO3: Learnt the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO4: Learnt concepts of Prolog and Implement the Prolog Program.
CO5: Learnt concepts of Expert system and Learning.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BCA(CCS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Professional Skills**
Course Code: 25BCACCS-405	**Title: Professional Skills**

Course Objectives:

CO1: Develop professional skills by understanding personal growth, workplace behavior, and continuous professional development.
CO2: Identify and strengthen professional talents through self-assessment, communication, teamwork, and leadership skills.
CO3: Apply goal-setting techniques and career planning strategies to achieve personal and professional objectives.
CO4: Gain practical workplace exposure by participating in internships and demonstrating professional responsibility.
CO5: Demonstrate ethical behavior, inclusivity, customer orientation, and collaboration to enhance employability skills.

Nature of Paper: AECC-4

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory-1 Hr.=1Credit
Practical-2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Professional Development: Meaning of professional development, importance of professional skills, types of professional development, lifelong learning, personal branding, work–life balance.	8
II	Identifying Professional Talents: Professional talents and skills, soft skills and hard skills, self-assessment, communication skills, teamwork, leadership, time management, emotional intelligence.	8
III	Goal Setting and Career Planning: Meaning of goals, SMART goals, steps of goal setting, career planning, self-assessment, career options, skill development, professional networking.	8
IV	Internship and Workplace Exposure: Meaning of internship, objectives of internship, types of internships, benefits of internships, employer and intern responsibilities, internship preparation.	8
V	Workplace Ethics and Employability Skills: Professional ethics, equality and equity, gender sensitivity, cultural diversity, customer service, collaboration, administrative skills, marketing and networking skills.	8

Text Books:

1. Covey, Stephen R. *The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change*. Free Press, 1989.
2. Locke, Edwin A., and Gary P. Latham. *A Theory of Goal Setting and Task Performance.* Prentice Hall, 1990.
3. Oldman, Mark, and Samer Hamadeh. *The Internship Bible*. Princeton Review Publishing, 2005.

Reference:

1. Robbins, Stephen P., and Timothy A. Judge. *Organizational Behavior*. Pearson Education, 2017.
2. Greenhaus, Jeffrey H., Gerard A. Callanan, and Veronica M. Godshalk. *Career Management*. SAGE Publications, 2019.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Classtasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: On completion of this module, students will be able to understand professional development, lifelong learning, and work–life balance.

CO2: By the end of this module, students will learn **to** identify their talents and build essential soft and hard skills.

CO3: After successful completion, students will be able to set SMART goals and plan their careers effectively.

CO4: At the conclusion of this module, students will be able to understand internships and prepare for workplace exposure.

CO5: Upon completing this module, students will be able to apply workplace ethics and key employability skills.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA(CCS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Big Data**
Course Code: BCA-NEP-503	**Title: Big Data**

Course Objectives:

CO1: Demonstrate knowledge of Big Data Analytics concepts and its applications in business.
CO2: Demonstrate functions and components of Map Reduce Framework and HDFS.
CO3: Develop queries in NoSQL environment
CO4: Explain process of developing Map Reduce based distributed processing applications.
CO5: Explain process of developing applications using HBASE, Pig etc.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	8
II	**Map-Reduce:** Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce.	8
III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop,	8
IV	**Hadoop Eco System and YARN:** Hadoop ecosystem components,	8

	schedulers, fairand capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. **No SQL** Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections	
V	**Hadoop Eco System Frameworks**: Applications on Big Data using Pig, Hive and HBase. **Pig** : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, **HBase**– Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, Big Insights and Big Sheets, introduction to Big SQL.	8

Text Book:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging.
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
3. Big-Data Black Book, DT Editorial Services, Wiley.

Reference Book:

1. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons
2. Pete Warden, “Big Data Glossary”, O’Reilly

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks /Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the concept of HDFS and map reduce.
CO2: Able to gather large data from a range of data sources.
CO3: Able to understand the hadoop ecosystem components
CO4: Able to explain the architecture of pig and hive with different operations.
CO5: Able to understand the importance and challenges of big data.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA(CCS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Data communication Network**
Course Code: BCA-NEP-503	**Title: Data communication Network**

Course Objectives:
CO1: To introduce the various types of computer networks.
CO2: To explore the various layers of OSI Model.
CO3: To introduce UDP and TCP Models.
CO4: To identify various application layer protocols.
CO5: To demonstrate the TCP/IP and OSI models

Nature of Paper: DSE

Minimum Passing Marks / Credits: 40% Marks / 4 Credits (Internal+ ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks	8
II	Data link layer: Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, HDLC, Point to Point Protocols. ALOHA, CSMA/CD, LAN – Ethernet IEEE 802.3, IEEE 802.5 – IEEE 802.11, Random access, Controlled access, Channelization.	8
III	Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services,	8
IV	Network layer: Logical Addressing, Internetworking, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.	8
V	Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.	8

Text Books:
1. Data Communications and Networking, Behrouz A. Farozan, Fourth Edition TMH, 2006.
2. Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.

Reference:

1. Data communications and Computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.
3. Computer Networking: A Top-Down Approach Featuring the Internet. James Kurose& Keith W. Ross, 3rd Edition, Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1. Students should understand and explore the basics of Computer Networks and Various Protocols.
CO2. Students will be in a position to administrate a network and flow of information.
CO3. Able to understand the World Wide Web Concepts.
CO4. Able to understand the concepts of network security
CO5. Able to secure device from network issues.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA(CCS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: ERP**
Course Code: BCA-NEP-503	**Title: ERP**

Course Objectives:

CO1: To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
CO2: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO3: To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
CO4: To develop a process driven thinking towards business processes.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to ERP:** Evolution of ERP; What is ERP? Reasons for the Growth of ERP; Scenario and Justification of ERP in India; Evaluation of ERP; Various Modules of ERP; Advantage of ERP.	8
II	**An Overview of Enterprise:** An Overview of Enterprise; Integrated Management Information; Business Modeling; ERP for Small Business; ERP for Make to Order Companies;. Business Process Mapping for ERP Module Design; Hardware Environment and its Selection for ERP Implementation	8
III	**ERP and Related Technologies:** ERP and Related Technologies; Business Process Reengineering (BPR); Management Information System (MIS); Executive Information System (EIS); Decision support System (DSS); Supply Chain Management (SCM).	8
IV	**ERP Market:** Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Co, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.	8
V	**ERP Implementation Lifecycle:** Issues in Implementing ERP Packages; Pre-evaluation Screening; Package Evaluation; Project Planning Phase; Gap	8

	Analysis; Reengineering; Configuration; Implementation; Team Training; Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).	

Text Books:

1. Daniel E.O' Leary, Enterprise Resource Planning Systems, Cambridge University Press, 2002.
2. Ellen Monk, Bret Wagner, Concepts in Enterprise resource planning, Cengage learning, 3rd edition, 2009.

Reference

1. Enterprise Resource Planning – Alexis Leon – 2nd Edition – TMH
2. Manufacturing Resource Planning (MRP II) with Introduction to ERP; SCM; an CRM by Khalid Sheikh, Publisher: Mc Graw-Hill

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: *Problem Solving using C*

Course Learning Outcomes:

CO1: Make basic use of Enterprise software, and its role in integrating business functions
CO2: Analyze the strategic options for ERP identification and adoption.
CO3: Design the ERP implementation strategies.
CO4: Analyze the strategic options for ERP identification and adoption.
CO5: Create reengineered business processes for successful ERP implementation.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA(CCS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Advanced Cyber Security and Computer Forensics (SPT-V)**
Course Code: BCA-NEP-511	**Title: Advanced Cyber Security and Computer Forensics**

Course Objectives:
CO1: Analyze and evaluate the cyber security needs of an organization.
CO2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
CO3: Measure the performance and troubleshoot cyber security systems.
CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
CO5: Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1 Hr.=1Credit
Practical-2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Computer Forensics in Today's World: -** Understanding Computer Forensics, Cyber Crime (Types of Computer Crimes), Cyber Crime Investigation, Rules of Forensics Investigation, Understanding Digital Evidence, Rules of Evidence, Forensics Readiness **Computer Forensics Investigation Process** Phases Involved in the Computer Forensics Investigation Process, Pre-investigation Phase, Investigation Phase, Post-investigation Phase.	8
II	**Understanding Hard Disks and File Systems:** Hard Disk Drive Overview, Disk Partitions and Boot Process, Understanding File Systems, RAID Storage System, File System Analysis **Data Acquisition and Duplication:** Data Acquisition and Duplication Concepts, Static Acquisition, Validate Data Acquisitions	8
III	**Defeating Anti-forensics Techniques** Anti-Forensics techniques, Password Protection, Recovering the Deleted Partitions, Steganography, Steganalysis, Artifact Wiping **Operating System Forensics (Windows, Mac, Linux)**	8

	Windows Forensics, Linux Forensics, MAC Forensics	
IV	**Network Forensics** Introduction to Network Forensics, Fundamental Logging Concepts, Event Correlation Concepts, Network Forensic Readiness, Network Traffic Investigation, Documenting the Evidence, Evidence Reconstruction	8
V	**Investigating Web Attacks** Web Attack Investigation, Investigating Web Server Logs, Tools for Locating IP Address	8

Text Books:

1. John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005.
2. Marjie T Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2nd Edition, 2008.

Reference

1. Mari E-Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", Jones & Bartlett Learning; 2nd Edition, 2014.
2. Chad Steel, "Windows Forensics", Wiley, 1st Edition, 2006.
3. Majid Yar, "Cybercrime and Society", SAGE Publications Ltd, Hardcover, 2nd Edition, 2013.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to evaluate cyber security of an organization.
CO2: Able to analyze a large amount of digital evidence and identify the most significant data.
CO3: Able to formulate a complete and adequate process plan for cyber system and measure against it.
CO4: Demonstrate the use of different computer forensic tools.
CO5: Ability for securing and handling of digital evidence.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA(CCS)**	**Year: III** **Semester: V**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: SPT-V Advanced Cyber Security and Computer Forensics Lab**
Course Code: BCA-NEP-512P	**Title: Advanced Cyber Security and Computer Forensics Lab (SPT- V)**

Course Objectives:
CO1: To learn about practices of digital investigation.
CO2: To practice different techniques and procedures that enables them to perform a digital investigation.
CO3: To analyze large amount of digital evidence and identify the most significant data.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal + ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Discuss different tools used for forensic investigation	2
II	Write the step by step procedure to hide and unhide inside animage file using command prompt in windows OS.	2
III	Write steps to Recover Deleted Files using 4FTK Imager Forensics Tools.?	2
IV	What is the procedure to mount animage using Access Data FTK Imager?	2
V	To use symmetric and asymmetric keys for protection of digital record.	2
VI	To carry out imaging 00 of hard disks.	2
VII	To identify, seize and preserve digital evidence from crime scenes	2
VIII	To detect deletions, obliterations and modifications of files using encase software	2

Reference / Text Books:
1. R.K. Tiwari, P.K. Sastry and K.V. Ravikumar, Computer Crimes and Computer Forensics, Select Publishers, New Delhi (2003).
2. C.B. Leshin, Internet Investigations in Criminal Justice, Prentice Hall, New Jersey (1997)

If the course is available as Generic Elective then the students of following departments may opt it.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/Sessional Examination	-
2) Presentations /Seminar	-
3) Assignments	-
4) Practical, Research Project Report	25

Seminar On Research Project Report 5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to :

CO1: Ensure the development of students applied skills in computer forensics related areas.

CO2: Able to identify the elements involved in investigation of digital crimes

CO3: Students will gain knowledge in apply a number of different computer forensic tools to a given scenario.

CO4: Able to implement digital evidence collection and preservation.

CO5: Able to analyze acquisition methods for digital evidence related to system security.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA(CCS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: SPT- VI (Web Technologies)**
Course Code: BCA-NEP-513	**Title: Web Technologies**

Course Objectives:
CO1: Analyze a web page and identify its elements and attributes.
CO2: Create web pages using XHTML and Cascading Style Sheets.
CO3: Build dynamic web pages using JavaScript (Client-side programming).
CO4: Create XML documents and Schemas.
CO5: To develop an ability to design and implement static and dynamic website.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal+ ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Web Page, Website, Web Browser, Internet Address, Uniform Resource Locator (URL), Web Essentials: Clients, Servers, and Communication; Web Servers-Apache, IIS, Proxy Server, HTTP Request Message-Response Message; Web Hosting, TCP/IP Protocol Suite, Installation and Managing Web-Server: IIS/XAMPP/LAMP, Browser Architecture and Web Site Structure	8
II	**HTML:** Basics of HTML, Formatting and Fonts, Commenting Code, Color, Hyperlink, Lists, Tables, Images, Forms, XHTML, Meta Tags, Character Entities, Frames and Frame Sets, Audio and Video.	8
III	**Cascading Style Sheets (CSS):** Need for CSS, Introduction to CSS, Basic Syntax and Structure, Using CSS, Background Images, Colors and Properties, Manipulating Texts, Fonts, Borders and Boxes, Margins, Padding, Lists	8
IV	**XML:** Introduction, Features, XML Document Structure, XML Markups-Element Markup, Attribute Markup, Naming Rules, Components, Comments, Document Type Definitions (DTD)– Internal and External DTD, Developing DTD, Well Formed XML Documents, Valid XML Documents, Validating an XML document using a DTD, XML Schema, Displaying XML Documents, XSL and CSS, XML Namespaces, XML DOM, Extensible Style sheet Language Transformations (XSLT).	8
V	**Java Script**-Introduction, Client-Side Java Script, Server-Side Java Script, Data Types, Java Script Objects, Control Structures, Function, Operators,	8

	Statements, Document and Its Associated Objects, Events and Event Handlers, Java Script Security.	

Text Books:

1. Aravind Shenoy, "*Thinking in HTML*", Packt Publishing.
2. Suehring "*Java Script Step by Step*", Prentice Hall India Learning Private Limited.
3. Behrouz A. Forouzan, "*Data Communication and Networking*", Tata McGraw Hill.

Reference

1. A.S. Tanenbaum, "*Computer Networks*", Pearson Education Asia.
2. Uttam Kumar Roy, "*Web Technologies",* Oxford University Press.
3. Raj Kamal, "*Internet and Web Technologies",* Tata McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe and differentiate different Web Extensions and Web Services.
CO2: Apply fundamental computer theory to basic programming techniques and fundamental skills to maintain web server services required to host a website.
CO3: Select and apply markup languages for processing, identifying, and presenting of information in web pages.
CO4: Use scripting languages and web services to transfer data and add interactive components to web pages.
CO5: Create and manipulate web media objects using editing software.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BCA(CCS)**	**Year: III** **Semester: V**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: SPT-VI Lab (Web Technology Lab)**
Course Code: BCA-NEP-514P	**Title: Web Technologies lab**

Course Objectives:
CO1: Develop static web pages using HTML.
CO2: Design dynamic web pages using Java script and XML.
CO3: Develop Java programs for window/web-based applications.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal+ ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write HTML/Java scripts to display your CV in navigator, your Institute website, Department Website and Tutorial website for specific subject.	2
II	Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access	2
III	Write programs using Java script for Web Page to display browsers information.	2
IV	Write a Java applet to display the Application Program screen i.e. calculator and other.	2
V	Program to illustrate JDBC connectivity	2
VI	Design and implement a simple shopping cart example with session tracking API.	2
VII	Create a style sheet in CSS/ XSL & display the document in internet explorer.	2
VIII	Create MS Access Database, Create on ODBC link.	2

Reference / Text Books:
1. RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. Pankaj Jalote, Software Engineering, Wiley
3. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
4. K.K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report	-
Seminar On Research Project Report	
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Write web-based applications.
CO2: Develop static and dynamic web pages using HTML.
CO3: Design dynamic web page using server site programming.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA(C& CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Advance Computer Forensics (SPT - VII)**
Course Code: BCA-NEP-611	**Title: Advance Computer Forensics (SPT - VII)**

Course Objectives:
CO1: Overview of database and Cloud Forensics.
CO2: Learn different techniques and procedures that enable them to perform Packet Analysis.
CO3: Analyze large amount of digital evidence and Malware Analysis techniques and their behavior.
CO4: Overview of dark forensics.
CO5: Digital investigation report writing such as preservation, analysis and acquisition of artifacts

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Database Forensics:** MSSQL Forensics, MySQL Forensics **Cloud Forensics:** Usage of Cloud Forensics, Stakeholders and their Roles, Investigating Cloud Storage Services **Malware Forensics:** Malware Analysis: Static, Malware Analysis: Dynamic, Analysis of Malicious Documents, Malware Analysis Challenges	8
II	**Investigating Email Crimes:** Email System, Email Crimes (Email Spamming, Mail Bombing/Mail Storm, Phishing, Email Spoofing,Crime via Chat Room, Identity Fraud/Chain Letter), Steps to Investigate Email Crimes and Violation, Examine E-mail Messages, Laws and Acts against Email Crimes.	8
III	**Mobile Phone & IOT Forensics:** Mobile Forensics Process, Forensics Imaging, Platform Security Removal Techniques: Jailbreaking/Rooting	8
IV	**Android Forensics Analysis:** Dark Web Forensics, Dark Web Forensics, Tor Browser Investigation, Checking Files	8
V	**Forensics Report Writing and Presentation:** Writing Investigation Reports, Expert Witness Testimony, Deposition, Dealing with Media	8

Text Books:
1. Ndatinya, V., Xiao, Z., Manepalli, V. R., Meng, K., & Xiao, Y. (2015). Network forensics analysis using Wireshark. International Journal of Security and Networks, 10(2), 91-106.
2. Computer Forensics and Cyber Crime: An Introduction", Marjie T. Britz

Reference

1. "The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory", Michael Hale Ligh, Andrew Case, Jamie Levy, AAron Walters.
2. Computer Evidence Collection &Presentation by Chrostopher L.T. Brown ,Firewall Media.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Able to perform database and Cloud Forensics.
CO2: Distinguish different techniques and procedures that enable them to perform Packet Analysis.
CO3: Able to analyze large amount of digital evidence and Malware Analysis techniques and their behavior.
CO4: Able to perform dark forensics.
CO5: Able to report writing such as preservation, analysis and acquisition of artifacts.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: VI

Programme: Degree **Class: BCA(C & CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Artificial Intelligence**
Course Code: BCA-NEP-613	**Title: Artificial Intelligence**

Course Objectives:

CO1: To understand about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: To study the concepts Propositional logics , predicate Logic
CO3: To understand the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO4: To understand concepts of Prolog and Implement the Prolog Program
CO5: To learning concepts of Expert system and Learning.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).	**9**
II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, No deductive Inference Methods, Rules.	**9**
III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts	**9**
IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/output and Streams, Databases, Implementation of All Concepts in Prolog.	**9**
V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition, Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Example-Induction, Explanation Based	**9**

	learning.	

Text Books:

1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. Dan W. Patterson, *"Introduction to Artificial Intelligence& Expert Systems"*, PHI.
2. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.

Referential Books

1. Stuart J. Russell &Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall.
2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Artificial Intelligence

Course Learning Outcomes:

CO1: Learn about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: Learn study the concepts Propositional logics, predicate Logic.
CO3: Learn the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO4: Learn concepts of Prolog and Implement the Prolog Program.
CO5: Learn concepts of Expert system and Learning.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA(C & CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mobile Computing**
Course Code: BCA-NEP-603	**Title: Mobile Computing**

Course Objectives:
CO1: To understand the basic concepts of mobile computing.
CO2: To learn the basics of mobile data management system.
CO3: To be familiar with the network layer protocols and Ad-Hoc networks.
CO4: To know the basis of transaction and application layer protocols.
CO5: To gain knowledge about different mobile platforms and application development.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Mobile Computing:** Issues in Mobile Computing, Wireless Telephony, Digital Cellular Standards, Bluetooth Technology, Wireless Multiple Access Protocols, Channel Allocation in Cellular Systems. Wireless Application Protocol, WRITE A PROGRAM technology, Mobile Information device, Mobile Computing Applications.	8
II	**Data Management Issues:** Mobility, Wireless Communication and Portability, Data Replication and Replication Schemes, Basic Concept of Multihopping, Adaptive Clustering for Mobile Network, Multicluster Architecture.	8
III	**Location Management:** Location Based Services, Automatically Locating Mobile Uses, Locating and Organizing Services, Issues and Future Directions, Mobile IP, Comparison of TCP and Wireless.	8
IV	**Transaction Management:** Data Dissemination, Cache Consistency, Mobile Transaction Processing, Mobile Database Research Directions, Security Fault Tolerance for Mobile N/W.	8
V	What is Ad-hoc Network?, Problems with Message Routing in Wireless Ad-hoc Mobile Networks, Routing scheme based on signal strength, Link state and Distance Vector routing protocols, Ad-hoc on Demand Distance Vector .	8

Text Books:

1. Shambhu Upadhyaya, Abhijeet Chaudhary, Kevin Kwiat, Mark Weises, “Mobile Computing”, Kluwer Academic Publishers.
2. UWE Hansmann, Lothar Merk, Martin-S-Nickious, Thomas Stohe, “Principles of Mobile Computing”, Springer International Edition.

3. Wireless and Mobile Networks Architectures, by Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001.

Reference

1. Mobile and Personal Communication systems and services, by Raj Pandya, Prentice Hall of India, 2001.
2. Wireless Web Development, Ray Rischpater, Springer Publishing, 2000.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand about mobile communication with their different routing algorithms.
CO2: Apply different data backup schemes used in mobile network to store the data.
CO3: Able to explain about location management that is much important for mobile network.
CO4: Build the knowledge of how transactions are done through mobile, different security issues while mobile transaction.
CO5: Appraise different routing protocols used for routing the path like ADDV, DSR, FSR etc.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA(C & CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: E-Commerce**
Course Code: BCA-NEP-603	**Title: E-Commerce**

Course Objectives:
CO1: Impart the students with knowledge and understanding of contemporary trendsin e-commerce.
CO2: Explain electronic system and Internet.
CO3: Describe the use of e-commerce security.
CO4: To provide adequate knowledge and understanding about E-Com practices to the students.
CO5: Understand the usage of planning and marketing for e-commerce.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**An introduction to Electronic commerce**: What is E-Commerce (Introduction and Definition), Main activities E-Commerce. Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, Electronic Commerce and Electronic Business (C2C) (C2G; G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C)	8
II	**The Internet and WWW:** Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.), Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Barter, Exchange, Shopping Bots	8
III	**Internet Security:** Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime (Laws, Types of Crimes), Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus (How it spreads, Virus problem, virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authorization and Authentication, Firewall, Digital Signature.	8
IV	**Electronic Data Exchange:** Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash	8

V	**Planning for Electronic Commerce:** Planning Electronic Commerce initiates, Linking objectives to business strategies, Measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites. **Internet Marketing;** The PROS and CONS of online shopping, The cons of online shopping. Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.	8

Text Books:

1. G. S. V. Murthy, E-Commerce Concepts, Models, Strategies:- Himalaya Publishing House, 2011.
2. Kamlesh K. Bajaj and Debjani Nag, E- Commerce, 2005.

Reference

1. Gray P. Schneider, Electronic commerce, International Student Edition, 2011.
2. E-Commerce, Fundamentals and Applications, Wiely Student Edition,

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/ Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Identify and explain fundamental web site tools including design tools, programming tools, and data processing tools.
CO2: Apply the solutions on finding major electronic payment issues and options.
CO3: Acquire the knowledge of security issues and explain procedures used to protect against security threats.
CO4: Communicate effectively in ways appropriate to the discipline, audience and purpose.
CO5: Implement the corrective measures to management issues underlying e-Commerce issues including organizational structure, strategic planning, goal setting.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA(C & CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Real Time System**
Course Code: BCA-NEP-603	**Title: Real Time System**

Course Objectives:
CO1: To study the basic of tasks and scheduling.
CO2: To understand programming languages and databases.
CO3: To analyze real time communication.
CO4: To analyze evaluation techniques and reliability models for Hardware Redundancy.
CO5: To understand clock synchronization.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**INTRODUCTION TO TASK SCHEDULING:** Introduction - Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real time Systems, Task Assignment and Scheduling – Classical uni processor scheduling algorithms, RM algorithm with different cases.	8
II	**UNI AND MULTI PROCESSOR SCHEDULING:** Uni processor scheduling of IRIS tasks, Task assignment, Utilization balancing – Next fit- Bin packing- Myopic off-line - Focused addressing and bidding- Buddy strategy- Fault Tolerant, Scheduling-A periodic scheduling - Spring algorithm.	8
III	**REAL TIME COMMUNICATION :** Introduction – VTCSMA – PB CSMA- Deterministic collision resolution protocol- DCR for multi packet messages- dynamic planning based- Communication with periodic and a periodic messages.	8
IV	**REAL TIME DATABASES :** Basic Definition, Real time Vs General purpose databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Maintaining Serialization Consistency, Databases for Hard Real Time System.	8
V	**REAL-TIME MODELING AND CASE STUDIES :** Petri nets and applications in real-time modeling, Air traffic controller system – Distributed airdefense system.	8

Text Books:

1. Jane W. S. Liu, "Real-time systems", 1st Edition, Prentice Hall, 2000.
2. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wiley & Sons, 2004.
3. C. Siva Ram Murthy, G. Manimaran, "Resource management in real-time systems and networks", PHI, 2009.

Reference

1. C.M. Krishna, Kang G. Shin, "Real Time Systems", Tata Mc. Graw - Hil, 2010.
2. Giorgio C. Buttazzo, "Hard real-time computing systems: predictable scheduling algorithms and applications", Springer, 2008.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course:NIL

Course Learning Outcomes:

CO1: Understand the features and structures of practical Operating System implementations.
CO2: Acquire practical knowledge Real Time Operating Systems used in embedded system.
CO3: Understand the use of multitasking techniques in Real Time Systems.
CO4: Compare different scheduling algorithms and the schedule ability criteria.
CO5: Analyze real time systems with regard to keeping time and resource restrictions.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BCA(C & CS)**	**Year: III** **Semester: VI**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Advanced Computer Forensics Lab (SPT-VII)**
Course Code: BCA-NEP-612P	**Title: Advanced Computer Forensics Lab (SPT-VII)**

Course Objectives:
CO1: To learn about practices of digital investigation.
CO2: Implement digital evidence collection and preservation.
CO3: Analyze acquisition methods for digital evidence analysis and acquisition of artifacts

Nature of Paper: Core

Minimum Passing Marks/Credits: 50 Marks % Marks / 2 Credits

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	To trace routes followed by e-mails and chats	2
II	To identify the IP address of the sender of e-mails.	2
III	To demonstrate concealment techniques using cryptographic PGP.	2
IV	To identify encrypted files.	2
V	To identify hidden files.	2
VI	To use digital signatures for securing e-mail and online transactions.	2
VII	To acquire data from PCs/laptops/HDDs/USBs, pen drives, memory cards and SIM cards	2
VIII	To use symmetric and asymmetric keys for protection of digital record.	2

Reference / Text Books:
1. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
2. E. Casey, Digital Evidence and Computer Crime, Academic Press, London (2000).

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to :
CO1: Ensure the development of students applied skills in computer forensics related areas.
CO2: Able to identify the elements involved in investigation of digital crimes
CO3: Students will gain knowledge in apply a number of different computer forensic tools to a given scenario.
CO4: Able to implement digital evidence collection and preservation.
CO5: Able to analyze acquisition methods for digital evidence preservation, analysis and acquisition of artifacts.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: VI

Programme: Degree **Class: BCA(C & CS)**	**Year: III** **Semester: VI**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Artificial intelligence lab**
Course Code: BCA-NEP-614P	**Title: Artificial intelligence lab**

Course Objectives:
CO1: Ability to apply standard practices and methodologies in software development and project management.
CO2: Apply various search algorithms of artificial intelligence.
CO3: Understand the concept of Artificial intelligence.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50 % Marks / 2 Credits

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a program in prolog to implement simple facts and Queries	2
II	Write a program in prolog to implement simple arithmetic	2
III	Write a program in prolog to solve Monkey banana problem	2
IV	Write a program in prolog to solve Tower of Hanoi	2
V	Write a program in prolog to solve 8 Puzzle problems	2
VI	Write a program in prolog to solve 4-Queens problem	2
VII	Write a program in prolog to solve Traveling salesman problem.	2
VIII	Write a program in prolog for Water jug problem	2

Reference / Text Books:
1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. Dan W. Patterson,*"Introduction to Artificial Intelligence& Expert Systems"*, PHI.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: To understand the concept of Artificial intelligence.

CO2: To understand the design principles of pattern recognition with estimation and apply classification technique. CO3: To apply knowledge representation and reasoning techniques.

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Ordinance & Academic Regulations
Bachelor of Computer Science (B.Sc.-CS)
(Academic Handbook 2025-26)

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1. PREAMBLE

As the technological enhancement and availability of technology to every person of world a huge demand of computer skilled professional is ample. In this world of opportunities, impact of higher education is so inevitable for getting desired guidance to secure, right kind of employment. It is compulsory to pursue higher related education in the best institutes. In this direction major reforms are to opt Learning Outcomes-based Curriculum Framework (LOCF), specially, in the undergraduate education (UG) program, that ensure student centric, interactive and outcome-oriented goals, objectives and skill enhancement to acquire. LOCF along with National Education Policy (NEP) in this regard ensure uniform education fabric of standard and content delivery education all over the nation. This syllabus development is a step to ensure development of the undergraduates for both, academia and employability. Latest technical trends, industry standards, market needs, and interests of students, future expectations the need has been taken into consideration while developing the syllabus.

The LOCF inculcation is to build up a comprehensive course structure with detailed syllabus. This is an effort to develop a student centric framework where they are expected to have a concrete understanding of fundamentals of computer science along with the latest trends and techniques like Artificial Intelligence, Internet of Things (IoT), Machine Learning (ML) with advanced skill sets that include Mobile Application environment, Object Oriented Programming (OOPs) among many courses. Each course aims to present learning targets and objectives, and thus provide learning and teaching strategies, assessment and resources. The students shall be equipped with the latest trends in computer science, after completion of the programme.

With this an education temple of nation should ensure an environment, which should be bias free, irrespective of cast, religion, races, sex difference and easily available to youths of the nation. The human value, ethics and environmental teaching is also introduced with this.

2. DEFINITIONSANDNOMENCLATURE

In these Regulations, unless the context otherwise requires:

1. "Programme" means Degree Programme like Bachelor of Computer Science (B.Sc.-CS). Hence further B.Sc.-CS and B.Sc.-CS (Data Science) will call B.Sc.-CS in this document.
2. "GPA" means Grade Point Average.
3. "Course" means a theory or practical subjects that are normally studied in a semester.
4. "VC, Vice-Chancellor of IIMT-University" means the Head of the University.
5. "Registrar" is the Head of all academic and General Administration of the University.
6. "Dean" means the authority of the school that is responsible for all academic activities of various programmes and implementation of relevant rules of these Regulations pertaining to the Academic programmes.
7. "COE, Controller of Examinations" means the authority of the University who is responsible for all activities related to the University Examinations, publication of results, award of grade sheets and degrees.
8. "Dean – Student Welfare" is responsible for all student related activities including student discipline, extra and co–curricular activities, attendance and meetings with class representatives, Student Council, and parent–teacher meeting.
9. "HoD" means the Head of the Department concerned.
10. "University" means IIMT-University, Meerut.
11. "TCH" means Total Contact Hours–refers to the teaching–learning periods.
12. "DEC" means Department Exam Committee.

13. "BoS" means Board of Studies.
14. "ACM" means Academic Council Meeting the highest authoritative body for approval for all Academic Policies.
15. "Class Coordinator" is a faculty of the class who takes care of the attendance, academic performance, and the general conduct of the students of that class.
16. "IA" is Internal Assessment, which is assessed for every student for every course during the semester.
17. "ESE" is End Semester Examination conducted by the University at the End of the Semester for all the courses of that semester.
18. "UGC" means University Grants Commission.
19. "MHRD" means Ministry of Human Resource Development, Govt. of India.
20. "AICTE" means All India Council of Technical Education.
21. "HEI" means Higher Education Institutions.
22. "PRN" means Permanent Registration Number.
23. "CGPA" means Cumulative GPA.
24. "SGPA" means Semester GPA.
25. "NC" means Non-Credit.

3. VISION AND MISSION OF THE SCHOOL

VISION

To achieve heights in computer education domain by creating appropriate environment for students, faculties and staff with availability of latest technological infrastructure.

MISSION

1. To dissipate appropriate all types of practical and theoretical computer science knowledge to our young students.
2. Inculcate professional efficiency in the students for brighter career opportunity as per industry latest requirement.
3. To provide learning environment for students with our reputed academics, partner in the field of computer science.
4. To prepare our student as an IT professional with full of ethics and human values.

4. PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: The graduates are designed to produce skill graduates who will be competent professionals in academics, industry and organizations of government and private sector.

PEO2: The pass out graduates will be able to handle the fast-changing world requirements and will become effective professionals.

PEO3: The successful Graduates will be a good team leader and will be able to lead the team to find optimal solutions and achieve expertise in their field or become entrepreneurs and play the leading roles in all types of organizations.

5. PROGRAM OUTCOMES (PO'S)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and receive clear instructions.
PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.
PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

6. PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1: To equip the graduates with practical knowledge and give hands on experience to them.
PSO2: To expose the students to the basic concepts of integration, differentiation, vector calculus, probability & statistics, and discrete mathematics.
PSO3: To equip graduates with the study of design, development and analysis of software.
PSO4 To aware graduates about the benefits of data storage and create awareness of new trends in database management system.

7. ADMISSION

Hence, further B.Sc.-CS and B.Sc.-CS (Data Science) will be called B.Sc.CS in this document. The admission policy and procedure shall be decided from time to time by the University based on the guidelines issued by the UGC/ Ministry of Education, Government of India. Seats are also made available for Non-Resident Indians and foreign nationals, who satisfy the admission eligibility norms of the University as per the UGC Norms.

8. ELIGIBILITYIN ALL YEARS AS PER NEP (ENTRY)

8.1 Candidate should have passed "10+2" exam (recognized board) in any stream with at least

40% in aggregate.

8.2 Admission will be based on academic record.

8.3 The Academic Council shall have power to amend or repeal the eligibility criteria laid down at clause 8.1& 8.2, if required.

9. CURRICULUM

The curriculum for Bachelor of Computer Science Programme is designed to have minimum and maximum credits as per the scheme of 120-160 credits that are distributed across six semesters of study for the award of degree.

10. MEDIUM OF INSTRUCTION

The medium of instruction is ENGLISH for all courses, examinations, seminar presentations and project reports.

11. CHOICE BASED CREDIT SYSTEM (CBCS)/ LOCF/ OBE

11.1 The three-year curriculum has been divided into six semesters. Semester Ist to VIth shall include lectures, tutorials, practical, seminars and project work as defined in the scheme of instruction and examination issued by the University from time to time.

11.2 The curriculum will be also including such other curricular, co-curricular and extra- curricular activities as may be prescribed by the University from time to time. Credit System BCA programme will have a curriculum in which every course will be assigned certain credits reflecting its weight and contact periods per week, as given below:

1 Lecture period (L) per week = 1 Credit
1 Tutorial period (T) per week = 1 Credit
1 Practical period (P) per week = 0.5 Credit

In addition to theory and laboratory courses there may be other courses such as seminar, project etc., which will be assigned credits as per their contribution in the programme without regard to contact periods.

11.3 Minimum Credit Requirements

The minimum credit required for award of a B.Sc.-CS degree is 120**.** This is normally divided into theory courses, tutorials, laboratory courses, seminars and projects in duration of six semesters. The credits are distributed semester wise as shown in the structure and syllabus manual of the programme. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester wise schedule of courses given in the syllabus manual of the programme.

11.4 Course Categories

Under CBCS, the degree programme will consist of the following categories of courses as per following table:

Table 11.4 - Distribution of Credits (Evaluation Scheme)

S. No.	Category	
1.	Core Course (Theory)-CC	**As per Format 1 & 2 of CBCS**
2.	Core Course (Practical)-CC(P)	
3.	Discipline Specific Elective (Theory)- DSE	
4.	Generic Elective (Theory)-GE	
5.	Ability Enhancement Compulsory Courses-AECC	
6.	Skill Enhancement Courses-SEC	
7.	Research Project (RP)	

11.5 Curriculum Structure

The curriculum for B.Sc.-CS will contain a listing of all courses, with each course having a course category, course number, course title, number of contact periods per week, number of credits assigned, and the marks assigned to various components of evaluation.

11.6 Approval of the Curriculum

The curriculum for B.Sc.-CS programme will be prepared by the Department concerned and will be approved by the Board of Studies of the Department. The Academic Council for final approval and then the Curriculum will be implemented. Same procedure shall be used for any modification in the Curriculum.

12. REGISTRATION FOR A COURSE IN A SEMESTER

A student will be eligible for registration of courses only if he/she satisfies the regulation (progression), and has cleared all dues to the University, Hostel and Library up to the end of the previous semester if student is not debarred from enrolment on disciplinary grounds.

The university follows a flexible Choice Based Credit System and slot-based table. Accordingly, the students shall be given the option for selecting their courses, credits, teachers, slots and create their timetable. The student is given the option of selecting the number of credits to undergo in a semester, subject to the curriculum requirements.

Except for the first-year courses, registration for a semester will be done during a specified week before the start of the semester as per the academic calendar.

Late registration /enrolment will be permitted by the Dean of the School for genuine cases, on recommendation by the Head of the respective department, with a late fee as decided from time to time.

The student shall make the choice of course in consultation with the Class Coordinator and as stipulated from time to time.

Students shall have to pay additional fee as prescribed, for registering in certain elective courses under Generic Electives courses offered by certain specific departments and for higher level Foreign Languages, as decided from time to time.

13. ATTENDENCE

The faculty handling a course must finalize the attendance, three calendar days before the last instructional day of the course and submit to the HoD through the class teacher.

13.1 Condonation of Medical Cases

a. A student with less than 75% attendance (Total Contact Hours -"TCH") in any course,

will not be permitted to appear for the end-semester examination in that course, irrespective of the reason for the shortfall of the attendance. The student is however permitted to avail Academic Leave up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD. After the event, the student should submit the relevant documents for proof to the HoD for approval of the Academic Leave.

b. The remaining 25% allowance in attendance is given to account for activities under NCC / NSS / Cultural / Sports/ Minor Medical exigencies etc.

c. Students under "CO (Carry Over)" category in any course shall attend the immediately following Summer/Winter course. The detailed schedule of the Summer/Winter courses offered in every semester will be announced during the end of that semester. The students who have obtained "CO (Carry Over)" have to select their appropriate slots and courses, optimally to attend the courses.

13.2 Additional Condonation

Additional Condonation may be considered in rare and genuine cases which includes, approved leave for attending select NCC/Sports Camps, cases requiring prolonged medical treatment and critical illness involving hospitalization. For such select NCC/Sports Camps prior permission for leave shall be obtained by the respective Dean/Director of sports from the designated authority, before deputing the students.

For medical cases, submission of complete medical history and records with prior information from the parent / guardian to Dean (Students Welfare) DSW is mandatory. The assessment of such cases will be done by the attendance sub – committee on the merit of the case and put-up recommendations to the Vice – Chancellor. Such condonation is permitted only twice for a student in the entire duration of the programme.

The Vice-Chancellor, based on the recommendation of the attendance sub-committee may then give condonation of attendance, only if the Vice-Chancellor deems it fit and deserving. But in any case, the condonation cannot exceed 10%.

14. ASSESSMENT PROCEDURE

14.1 Internal Assessment (IA) – 25 Marks & External Assessment (EA) - 75 Marks

14.2 Practical Assessment (as per format 1 and 2)

15. RESEARCH PROJECT/SEMESTER PROJECT – ASSESSMENT CRITERIA

The general guidelines for assessment of Project are given in Table 15.1

Table 15.1: Assessment pattern for Research Project / Semester Project

S. No.	Review / Examination Scheme	Broad Guidelines	Weightage
1	First Review	Concept	10%
2	Second Review	Design	10%
3	Third Review	Experiment/Analysis	20%
4	Final Review/ESM	Project report and Viva – Voce, Results and Conclusion	60%

16. INTERNSHIP – RESEARCH/INDUTRIAL INTERNSHIP

A student has to compulsorily attend summer internship at the end of 4th semester for a minimum period of 30 days. In lieu of Summer-Winter internship, the student is permitted to register for undertaking project work under a faculty of the University and carry out the project for minimum period of 30 days. In both the cases, the internship report in the prescribed format duly certified by the faculty in-charge shall be submitted to the HoD. The evaluation will be done through presentation and viva. The course will have a weight age as defined in the respective curriculum.

For the final year project and viva-voce end semester examination, the student shall submit a project report in the prescribed format issued by the University. The reviews will be conducted by a committee constituted by the HoD. The end semester assessment will be based on the project report and a viva on the project conducted by a committee constituted by controller of examination. This may include an external expert.

17. FOR NON – CGPA COURSES/AUDIT COURSES

The Assessment will be done based on the respective assessment as per rubrics issued by the HoD.

A student securing less than the minimum specified internal assessment marks in any course will not be permitted to appear for the end-semester examination in that course and will be graded under "CO (Carry Over)" category for that course. This will be denoted in the grade sheet as "CO (Carry Over)", till the course is successfully completed in the subsequent semester(s).

18. CREDIT WEIGHTAGE

Credits are the weightage, assigned to the courses based on the following general pattern:

One Hour	1 credits
Two Hour Practical	0.5 credits

19. MAXIMUM DURATION OF THE PROGRAMME/PROMOTION POLICY

A student may complete the programme at a slower pace than the regular pace, but in any case, in not more than **N+2 years**.

A student completing the degree programmes in the extended period will not be eligible for university ranking.

20. MAXIMUM GAPS BETWEEN SEMESTER/YEAR

A student may be permitted by the Vice-Chancellor to withdraw from the entire programme for a maximum of two semesters for reasons of ill health, start – up venture or other valid reasons as recommended by a committee consisting of Head of Department, Dean of School, and Dean (Student Welfare).

21. CREDIT SYSTEM & GRADING CGPA/SGPA

Introduction

IIMT University implemented the UGC guidelines to implement of the choice-based credit system with a view to offer student's choice of courses within a programme with a flexibility to complete the programme by earning credits at a pace decided by the students themselves.

The system allowed students to choose inter-disciplinary, intra-disciplinary courses according to their learning needs, interest and aptitude. It was considered as a cafeteria approach and was expected to provide mobility to students.

21.1 Credit System

As per the current credit system practiced in institutions needs comprehensive reforms as they offer very little flexibility, choice and are less learner centric. Degrees offered today are more self-contained focusing on a specialization area and depend a lot on knowledge available with the faculty from the department only. Though the most requisite credit system does exist, wherein students are given a wide choice and flexibility, these exist as small islands in the vast ocean of thousands of educational institutes in India. In such institutions, the curriculum is frequently designed which is learner centric and offering a wide specialization area for students to pick and choose courses from.

The institutions shall make attempts wherein the design of the credit system and the teaching and evaluation modes shall be the responsibility of individual course teachers. The students should have the freedom to opt for courses from other specializations and not just from their core specialization. For this there has to be stronger collaborations between departments of the University and outside.

21.2 Grading system

Most institutions follow the absolute grading system which is a simple procedure wherein the marks obtained by students correspond to a specific grade and grade point. It reflects the individual performance in a particular subject without any reference to the group/class. The absolute grading system has limitations and may be susceptible to some inconsistencies.

The relative grading system on the other hand provides relative performance of a student to a group/class wherein the student is ranked in a group/class on basis of relative level of achievement. In this system decisions are made in advance by the faculty members as to what proportion of students would be awarded a particular grade on the basis of their relative performance and which is done by assigning grades on basis of a normal curve. This facilitates comparative performance and eliminates negative effect of pass or fail.

Relative grading system may be used if the number of students registered for the course is at least 30. For a class of smaller size, an absolute grading scheme may be used. The statistical method may be used with adjustments to calculate the mean (M), median (Md) and standard deviation (SD) of the total marks (TM) obtained by the students registered for the course. If the mean and median coincide, the mean may be used for further computations, otherwise the median may be used. If suppose the mean is used, then the letter grades may be awarded based on the ranges specified in table below:

A grading system as shown in given table-

Table 21.2: Grading system

Letter Grade	Range
A+	TM>M+1.75SD
A	M+1.25 SD ≤TM<M+1.75SD
B+	M+0.75 SD ≤TM<M+1.25SD
B	M+0.25 SD ≤ TM < M+0.75 SD
C+	M-0.25 SD ≤ TM < M-0.25 SD

C	M-0.75 SD ≤ TM < M-0.25 SD
D+	M-1.25 SD ≤ TM < M-0.75 SD
D	M-1.75 SD ≤ TM < M-1.25 SD
E+	M-2.0 SD ≤ TM < M-1.75 SD
E	M-2.25 SD ≤ TM < M-2.0 SD
F	M-2.25 SD > TM
CO	Carry Over (Summer / Winter) due to Attendance deficiency (between 40% and 75%) and / or I. Lack of minimum IA marks as specified in clause 10.0 Table 3.
RA	Repeat the course due to (i) Lack of minimum attendance (below 40%) in regular course.
--	DETAINED "RC" or "RA" or both in all registered theory courses of a semester. The student is detained and has to repeat the entire semester. Clause 12.3

Letter grades may be improved based on the following scheme: Use the table above to determine grade boundaries. Look for natural gaps in the neighborhood of grade boundaries. Choose the largest gap in the neighborhood and make this as the grade boundary.

An 'E', 'E+' and 'F' grade may not be a purely relative grade. These may be assigned on the following basis:

- A minimum, say 30/100, may be set as pass marks for the course. A fail grade may then be awarded only if the Total Marks for the course are less than 30. Otherwise, the students may be awarded the Just Pass Grade D.
- A fail grade may be awarded to students whose marks are below the prescribed minimum even if the table above leads to a pass grade.

Similarly, a lower limit may be set for the A grade also, for instance greater than or equal to 86. Students not achieving the prescribed minimum may be awarded a lower letter grade even if the table above indicates otherwise. A pass grade may be made mandatory for both internal as well as external examinations in the case of a separate internal and external assessment,

a. Internal and External marks may be summed up with appropriate weightage to compute a total out of 100 marks. The letter grade may be assigned on this computed total.
b. Internal and external marks may be graded separately and then the assigned grade points may be used, with appropriate weightage, to compute a final grade point and letter grade.

Grading in the case of Re-evaluations, Retests and Remedial Examinations may be based on the following guidelines:

a. The ranges of marks once computed for awarding letter grades the first time, called the First Distribution (FD), will not be modified.
b. If a re-evaluation leads to a change in marks, then FD will be used to award an appropriate letter grade.
c. A retest may be permitted, if
    i. A student gets a letter grade of E+ or E. In this case, irrespective of the marks obtained, at most D grade may be awarded.
    ii. A student is unable to complete course requirements because of certified illness or tragedy. In this case FD will be used to award an appropriate letter grade.

The use of relative grading system may be recommended in autonomous institutions, institutes of national importance and institutions with high ranking. The results of the relative grading

system may be shared by such institutions later with other interested institutions to implement the same.

21.3 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i "and the grade points Pi earned for that course taken over all courses "i" registered and successfully completed by the student to the sum of Ci for all "i". That is,

$$GPA = \frac{\sum_i C_i P_i}{\sum_i C_i}$$

CGPA will be calculated in a similar manner, in any semester, considering all the courses enrolled from the first semester onwards.

21.2 The Grade card will not include the computation of GPA and CGPA for courses with letter grade CO, RC and U until those grades are converted to the regular grades.

21.3 A course successfully completed cannot be repeated.

Grade Sheet

Letter grade

Based on the performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and corresponding grade points are given in Table 8. A student is considered to have completed a course successfully and earned credits if he/she secures a letter grade other than F, CO, RA in that course.

After results are declared, grade sheet will be issued to each student which will contain the following details:

a. Program and discipline for which the student has enrolled.
b. Semester of registration.
c. The course code, name of the course, category of course and the credits for each course registered in that semester
d. The letter grade obtained in each course
e. Semester Grade Point Average (GPA)
f. The total number of credits earned by the student up to the end of that semester in each of the course categories.
g. The Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.
h. Credits earned under Non CGPA courses.

22. CLAS/DIVISION

22.1 Classification is based on CGPA and is as follows:

CGPA ≥ 8.0 : **First Class with distinction**
6.5 ≤ CGPA <8.0 : **First Class**
5.0 ≤ CGPA <6.5 : **Second Class**

22.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in

his/her first appearance with effect from II semester, within the minimum duration of the programme.

(ii) The award of 'First Class' is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses within 3 years for Bachelor of Computer Application.

(iii) The period of authorized break of the programme (vide clause 11.0) will not be counted for the purpose of the above classification.

23. TRANFER OF CREDITS/ACADEMIC CREDIT BANK

23.1 "Credit-transfer" means the mechanism by which the eligible HEIs registered with ABC are able to receive or provide prescribed 'credits' to individual registered ABC account in adherence to the UGC credit norms for the 'course/s' registered by the desirous students in any eligible higher education institution within India

23.2 Within the broad framework of these regulations, the Academic Council, based on the recommendation of the Credit Transfer Committee so constituted may permit students to transfer part of the credit earned in other approved Universities of repute & status in the India or abroad.

23.3 The Academic Council may also approve admission of students who have completed a portion of course work in another approved Institute of repute under Multiple entry & Exit system, based on the recommendation of the credit transfer committee on a case-to-case basis.

23.4 Students who have completed coursework, at least first year, at some university other than the university to which transfer is to be sought, may request for transfer of admission to this university. A student may be granted admission only through an admission process that will follow the same policy as for fresh admissions. However, a uniform credit system must be followed by all universities to effect transfer of credits.

23.5 Credit Transfer request can be submitted only after the student has been admitted in the concerned program and the following conditions are met:
University Grants Commission initiated the concept of National Academic Credit Bank (NAC-Bank) which will be a digital / virtual / online entity to be established and managed by UGC. The main objective of the NAC-Bank would be to facilitate student mobility across the education system wherein the credits can be accumulated and be used at alter point of time for the requirements of partial fulfillment of a degree program.

i. The course work has been completed at a UGC approved and accredited University through fulltime formal learning mode.
ii. The university accreditation grade/ ranking is not lower than that of the university to which the transfer is sought.
iii. The courses prescribe to the common minimum syllabus under UGC CBCS system.
iv. The letter grade obtained in the courses is "B" or better.
v. The number of credits to be transferred does not exceed the prescribed limit.
vi. The program in question must have a similar credit system, in particular, modular or semester and the same numeric and letter grading system along with common meaning of the term "credit" in numerical terms.

The aspect of shelf life of courses needs to be considered while accepting credits as obsolescence of knowledge of certain field in terms of its current relevance needs to be investigated. The time elapsed between successful completion of certain courses of the program and the admission to which program transfer is sought needs to be considered. The maximum number of credit points that may be considered under a credit transfer needs to be specified. Contextual variables such as teaching-learning approach adopted, learning facilities offered, use of evaluation modes may also be considered while preparing the credit transfer policy.

Moderation

Moderation of assessment is an organized procedure which ensures use of valid assessment material and consistent application of criteria, to provide fair academic judgment and reliable outcome in the form of marks or grades. It assures appropriate designing and implementation of assessment activities along with generation of valid and reliable results.

Integration of moderation process with assessment system is imperative for the development of academic quality in higher educational institutions as:

- It addresses any difference in individual judgments of different evaluators.
- It ensures that all achievements in the form of marks and grades across courses reflect achievement of same level of standard.
- It is also carried out to develop a common understanding of the standards and criteria and to recognize performance which demonstrates that standard or fulfils those criteria.

Moderation may be conducted in case there are large number of fail grades or high grades, or when large numbers of students who have received the same grade or clustering of students on letter grades, or when there are discrepancies between grades allocated to individual students in different courses, or to find out the difficulty level of the question paper or whether the assessments modes used cover the entire syllabus or not.

Applicability - Moderation will be made applicable to both external and internal modes of assessment. All programs and courses will indicate, as part of their statements on assessment, arrangements for the moderation of assessed work. This can be done through formulation of a moderation policy and implemented across all programs and courses of instruction and delivery. The time frame for the moderation will be linked with the time frame for assessment.

In the event moderation is triggered, an evaluation will begin with a discussion on the following (though not exhaustive) lines:

a. What are the rubrics used for each of the different types of assessment in the course? Is a standardized/ prescribed rubric used or has the instructor developed his/ her own rubric. If the instructor is using a personally framed rubric, or if there is no identified rubric, then how does the assessment map to learning outcomes?

b. The difficulty level of the questions included in the assessments, i.e., is the difficulty level on the extremes, very easy or very hard.

c. The manner of awarding marks, i.e., has the correction been at the extremes, liberal or tough.

Each department will establish a committee and designate roles and responsibilities at different levels for smooth working of the moderation process. In order to maintain neutrality, it will be ensured that moderator should not be the assessor. Staff members will be trained professionally in assessment techniques and moderation procedures. All assessment material produced by learner including examination sheets, assignments, project reports, research reports etc. will be examined.

Institutions will be encouraged to make the moderation process online. In this system, assessment plans, moderation plans, assessment tools, samples of which may be submitted

online. Moderation reports will be generated online so that progress can be tracked and submitted to the CoE after the approval of Dean and HoD. The moderation will not be restricted to just assessment but also include moderation of content and assessment design.

24. CHANGE OF DISCIPILINE

"Academic Flexibility" is the provision for innovative and inter change able curricular structures to enable creative combinations of Courses/Programmes in Disciplines of study leading to Degree/Diploma/PG Diploma/Certificate of Study offering multiple entry and multiple exit facilities in tune with National Education Policy-2020, while removing the rigid curricular boundaries and creating new possibilities of life-long learning.

25. USE OF TECNOLOGICAL INTERVENTIONS

With the proliferation of different types of access devices, especially mobile access devices, technology has the potential to augment traditional classroom practices and revolutionize learning and evaluation methods. Technology, in fact can be an important driver to enable lifelong learning. Learning and engagement of students is facilitated by use of technology through several modes such as synchronous learning, semi-synchronous learning, blended learning, collaborative learning, flipped classroom etc. MOOC's, especially provided through SWAYAM, are a window of opportunity for lifelong learning and are offered through technology-based platforms. Learning management systems (LMS) may be used by institutions to integrate the entire teaching, learning and evaluation process. The Learning Management System may be used by institutions to deliver academic content in blended form and to assess learning through thesis, assignments etc. Open-source learning management systems such as *Moodle, Edmodo* may be used for posting content in the form of videos, audios, e-learning modules, live class sessions etc. Use of plagiarism detection software will be highly recommended to check originality of the content.

In the conduct of examinations, universities face tremendous challenges such as need for trained manpower, distribution of question paper without delays and errors, delays in evaluation of answer scripts, lack of infrastructure to conduct examinations at a large scale, non-availability of faculty members for assessment, security issues faced during paper setting and paper distribution, tampering of certificates and answer scripts etc.

For a typical examination department of an institution will be an autonomous body right from registration of student to convocation through an integrated system. In fact, steps must be taken to implement a complete examination management system that considers the complete life cycle of examination process. The use of technology will reduce dependency on human intervention and be error free. The following functions will be automated:

i. Registration of students and generating unique PRN,
ii. Filling up of examination form,
iii. Generation of seat numbers and admit cards/hall tickets,
iv Preparation of list of paper setter,
v. Use of question bank system to draw question sets, question paper generation,
vi. Online distribution of question papers on the day of examination with system of encryption,
vii. Barcode system for answer books (this will eliminate issues related to errors, avoid malpractices etc.),
viii. Digitization of answer scripts and onscreen evaluation of answer sheets,
ix. Tracking of student's performance,

x. Marks submission through online software,
xi. Viewing of result through online system,
xii. Online verification and revaluation system,
xiii. Digitization of certificates and mark sheets (to avoid tampering and easy retrieval),
xiv. Certificate authentication system,
xv. Submission of various other applications through online system.

The above will lead to conduct of functions of the examination system in an efficient and transparent manner and timely availability of information to students.

26. STUDENT DESCIPILINE

Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige reputation of the University and School.

27. STUDENT WELFARE

Any act of indiscipline of a student reported to the Dean (Students Welfare) and Head of the Department will be referred to a Discipline Committee constituted for the purpose. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also authorize the Dean (Students Welfare) to recommend to the Vice-Chancellor for the implementation of the decision. The student concerned may appeal to the Vice-Chancellor, whose decision will be the final.

28. RAGGING

Ragging in any form is a criminal and non-bail able offence in our country. The current State and Central legislations provide stringent punishments including imprisonment. Once the involvement of a student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the University, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student at the University, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

29. POWER TO MODIFY

Not with standing all that has been stated above, the Academic Council is vested with powers to modify any or all the above regulations from time to time, if required, subject to the approval by the Board of Studies and final approval by Vice-Chancellor.

30. EXIT POINT

Exit point will be governed as per format 1 and format 2.

31. NC/CREDIT COURSE

For non-credit courses ‘Satisfactory’ or ‘Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

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Evaluation Scheme

B.Sc. (COMPUTER SCIENCE)
Year: I / Semester: I

S. No.	Subject Code	Subject Name	Course Type	Course Type	Evaluation Scheme						Credits
					Periods			Internal Marks	External Marks	Total Marks	
					L	T	P				
1	25BCS-CS101	Problem solving techniques using 'C' Language	C1	PP	3	0	0	25	75	100	3
2	24BCS-CS102	Mathematics-I	C2	PP	4	0	0	25	75	100	4
3	24BCS-CS103	Basics of Computers and Recent Trends	C3	PP	3	0	0	25	75	100	3
4	24BCS-CS104 24BCS-CS105 24BCS-CS106-3 24BCS-CS107-4	Select Any One- 1. ERP 2. M-Commerce 3. Feature Engineering 4. Basics of Data Analytics using Spread Sheet	DSE1	PP	4	0	0	25	75	100	4
5	NHU-111	English Communication	AECC1	PP	3	0	0	25	75	100	3
6	24BCS-CS106	Office Automation Tool	SEC1	PP	2	0	0	25	75	100	2
7	24BCS-CS108P	Office Automation Tools Lab	SEC1	PR	0	0	2	25	25	50	1
8	IEMM-402	Indian Ethos and Modern Management	VAC 1	PP	2	0	0	25	75	100	2
9	25BCS-CS107P	Problem solving techniques using 'C' Language Lab	C1 Lab	PR	0	0	2	25	25	50	1
10	24BCS-CS109P	Basics of Computers and Recent Trends Lab	C3 LAB	PR	0	0	2	25	25	50	1
11	SPT-PC-111	Sports			0	0	2	15	35	50	NC
		Grand Total			**21**	**0**	**8**	**265**	**635**	**900**	**24**

C1 - Core Course 1, C2 - Core Course 2, C3 – Core Course 3, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course

B.Sc. (COMPUTER SCIENCE)
Year: I / Semester: II

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						Credits
				Periods			Internal Marks	External Marks	Total Marks	
				L	T	P				
1	24BCS-CS201	Advance 'C' Programming	C4	3	0	0	25	75	100	3
2	24BCS-CS202	Mathematics-II	C5	4	0	0	25	75	100	4
3	24BCS-CS203	Digital Electronics and Computer System Architecture	C6	3	0	0	25	75	100	3
4	24BCS-CS204 24BCS-CS205 24BCS-CS206-1	**Select Any One-** 1.Digital Marketing 2.Information System 3.Artificial Intelligence	DSE2	4	0	0	25	75	100	4
5	24BCS-CS206P	Advance 'C' Programming Lab	C4 Lab	0	0	2	25	25	50	1
6	24BCS-CS207P	Digital Electronics and Computer System Architecture Lab	DSE2	0	0	2	25	25	50	1
7	NHU-NPR-112	Environment and Ecology	AECC2	4	0	0	25	75	100	4
8	NHU-NPR-112P	Environment and Ecology Lab	AECC2 Lab	0	0	2	25	25	50	1
9	Code to be provided from Schools of IIMTU	Generic Elective (To be opted from other Schools of IIMTU)	GE1	4	0	0	25	75	100	4
10	Code to be obtained from NPTEL	IPR/E&I [To be completed form NPTEL, Registration to be Initiated in January	SEC2	0	0	4	0	0	0	2
11	SPT-PC-211	Sports		0	0	2	15	35	50	1
		Grand Total		**22**	**0**	**8**	**240**	**560**	**800**	**28**
C4 - Core Course 1, C5 - Core Course 2, C6 – Core Course 3, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course IPR : Intellectual Property Rights , E&I : Entrepreneurship and Innovation										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course										

B.Sc. (COMPUTER SCIENCE)
Year: II / Semester: III

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						Credits
				Periods			Internal Marks	External Marks	Total Marks	
				L	T	P				
1	25BCS-CS301	Data Structure and Algorithm using 'C'	C7	3	0	0	25	75	100	3
2	25BCS-CS302	Operating Systems	C8	3	0	0	25	75	100	3
3	25BCS-CS303	DBMS	C9	3	0	0	25	75	100	3
4	25BCS-CS304-1 25BCS-CS304-2	Select Any One- 1. Block Chain 2. Data Mining and Data Warehousing	DSE-3	4	0	0	25	75	100	4
5	25BCS-CS305	R-Programming	SEC-3	2	0	0	25	75	100	2
6	25BCS-CS306	Cyber Security	VAC-2	3	0	0	25	75	100	3
7	25BCS-CS301P	Data Structure and Algorithm using 'C' Lab	C7 Lab	0	0	2	25	25	50	1
8	25BCS-CS302P	Operating Systems Lab	C8 Lab	0	0	2	25	25	50	1
9	25BCS-CS303P	DBMS Lab	C9 Lab	0	0	2	25	25	50	1
10	25BCS-CS305P	R-Programming Lab	SEC-3	0	0	2	25	25	50	1
11	UVE-401	Universal Human values & Professional Ethics	AECC-3	3	0	0	25	75	100	3
12	Code to be provided from Schools of IIMTU	Generic Elective (To be opted from other Schools of IIMTU)	GE-2	4	0	0	25	75	100	4
13	SPT-PC-311	Sports		0	0	2	15	35	50	NC
		Grand Total		**25**	**0**	**10**	**315**	**735**	**1050**	**29**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course										

B.Sc. (COMPUTER SCIENCE)
Year: II / Semester: IV

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						Credits
				Periods			Internal Marks	External Marks	Total Marks	
				L	T	P				
1	25BCS-CS401	OOPs using Java	C10	3	0	0	25	75	100	3
2	25BCS-CS402	Software Engineering	C11	3	0	0	25	75	100	3
3	25BCS-CS403	Computer Graphics	C12	3	0	0	25	75	100	3
4	25BCS-CS404-1 25BCS-CS404-2	Select Any One- 1. IOT 2. Mobile Application Development	DSE-4	4	0	0	25	75	100	4
5	25BCS-CS405	E&I/IPR through NPTEL	SEC-4	0	0	4	0	0	0	2
6	25BCS-CS401P	OOPs using Java Lab	C10 Lab	0	0	2	25	25	50	1
2	25BCS-CS402P	Software Engineering Lab	C11 Lab	0	0	2	25	25	50	1
7	25BCS-CS403P	Computer Graphics Lab	C12 Lab	0	0	2	25	25	50	1
8	25BCS-CS406	Professional Skills	AECC-4	3	0	0	25	75	100	3
9	Code to be provided from Schools of IIMTU	Generic Elective (To be opted from other Schools of IIMTU)	GE-3	4	0	0	25	75	100	4
10	SPT-PC-411	Sports		0	0	2	15	35	50	1
		Grand Total		**20**	**0**	**12**	**240**	**560**	**800**	**26**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course										

B.Sc. (COMPUTER SCIENCE)
Year: III / Semester: V

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						Credits
				Periods			Internal Marks	External Marks	Total Marks	
				L	T	P				
1	BCS-NEP-501	Computer Graphics	C1	4	0	0	25	75	100	4
2	BCS-NEP-502	Python Programming	C2	4	0	0	25	75	100	4
3	BCS-NEP-503	1. Data Communication Network 2. ERP 3. Big Data	DSE	4	0	0	25	75	100	4
4	RP-1 AUDIT	Research Project-I@	AUDIT	0	0	0	50	0	50	NC
5	BCS-NEP-IP-I	Internship	Industrial Internship (Mandatory)	0	0	10	50	50	100	5
6	BCS-NEP-504P	Computer Graphics Lab	CORE LAB 1	0	0	4	25	25	50	2
7	BCS-NEP-505P	Python Programming Lab	CORE LAB 2	0	0	4	25	25	50	2
		Grand Total		**12**	**0**	**18**	**225**	**325**	**550**	**21**

C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project, L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course

NOTE: @RESEARCH PROJECT – I is a Noncredit courses (Audit Courses) and Student needs to qualify it but the marks will not be added in total marks

B.Sc. (COMPUTER SCIENCE)
Year: III / Semester: VI

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						Credits
				Periods			Internal Marks	External Marks	Total Marks	
				L	T	P				
1	BCA-NEP-601	Cyber Security	C1	4	0	0	25	75	100	4
2	BCA-NEP-602	Artificial Intelligence	C2	4	0	0	25	75	100	4
3	BCA-NEP-603	1. Mobile Computing 2. E-Commerce 3. Real Time System	DSE	4	0	0	25	75	100	4
4	BCA-NEP-IP-II	Industrial Project	Minor Industrial Project	0	0	10	100	0	100	5
5	BCS-NEP-605P	Cyber Security Lab	CORE LAB 1	0	0	4	25	25	50	2
6	BCA-NEP-606P	AI Lab	CORE LAB 2	0	0	4	25	25	50	2
7	BCS-NEP-607	Research Project-II@	AUDIT	0	0	0	50	0	50	NC
8	BCA-NEP-607P	MOOC	SEC	4	0	0	50	0	50	4
9	*Code will be decided by parent department	GE-III (To be opted by the students as per the given electives in the list attached)	GE3 (Mandatory)	4	0	0	25	75	100	4
		Grand Total		**20**	**0**	**18**	**350**	**350**	**700**	**29**

C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project, L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course

NOTE: #GENERIC ELECTIVE TO BE DECIDED BY CBCS COMMITTEE

PROJECT – II is a Noncredit courses (Audit Courses) and Student needs to qualify it but the marks will not be added in total marks.

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Format-1

Format -1

NEP-2020 IMPLEMENTATION 3 STEPS PLAN (FORMAT-1,2 & 3)
CBCS: Statement of Credits distribution

College/School:SoCSA
Programme:BSC (CS)
Duration: UG (6 Sem.), UG (Hons./Research) 8 Sem., PG (4 Sem.)

Credit Range: Minimum 120 for UG
160 for UG (Hons.), 80 for PG
(Suggested by CBCS-NEP Committee)

Course	Credit	Semester	Core Major	DSE Minor	AECC	SEC **	GE Interdisciplinary	General Elective	Value Added Course (VAC)	Industrial Training/ Survey / Research Project	Total Credits
Certificate Course in Computer Science		Ist	**C 1** **1).** C Programming (Th 3+P2) **C 2** 2).Mathematics-I (Th 4) **C 3** 3). Basics of Computers and Recent Trends (Th 3+P2)	**DSE 1** **1).**ERP (Th4)/ **2).** M-Commerce (Th 4)	**AECC 1** English Communication (Th. 3)	**SEC 1** Office Automation Tools (Th 2 +T 2)		NCC	**VAC 1** Indian Ethos and Modern Managem-ent (Th2)		26 (Excluding NCC)
		2nd	**C 4** 1). Advance C Programming (Th3+P2) **C 5** 2). Mathematics -II (Th4) **C 6** 3). Digital electronics and Computer System Architecture (Th3+P2)	**DSE 2** 1). AI (Th 4)/ 2). Information System (Th4)	**AECC-2** Environment and Ecology(Th 4 P2)	**SEC 2** IPR (Th 2) (Through IIMTU/ NPTEL		GE 1 General Elective (to be opted from other school of IIMTU			29 (Excluding NCC)
Entry and Exit point											

Diploma in Computer Science		3rd	1). Data Structure and Algorithm using C (Th3+P1) 2). Operating Systems (Th 4) 3). DBMS (Th3+P1)	1). Block Chain (Th4)/ 2). Data Mining and Data Warehousi -ng (Th4)	AECC 3- Human values& Professional Ethics	R- Programmi ng (Th 1+P1)	GE 2 A/B	NCC	Cyber Security (Th3)		28 (Excluding NCC)
		4th	1). OOPs using Java (Th3+P1) 2). Software Engineering (Th4) 3). Computer Graphics (Th3+P1)	1). IOT (Th4)/ 2). Mobile Applicatio n Developm e-nt (Th 4)	AECC 4- Professional Skills	E&I (Th 2)	GE 3 A/B	NCC			25 (Excluding NCC)
Entry and Exit point **Note:** Summer Internship in between 4th and 5th Sem. During session break (6-8 weeks) (Credit-4)											

B.Sc. in Computer Science		5th	1). Theory of Computation (Th 4) 2). Python Programming (Th3+P1) 3). Computer Networks (Th3+P1)	1). Natural Language Processing (Th4)/ 2). Computer vision (Th4)			GE-3 A/B	NCC	Health & Wellness (Th2)	Summer Internship in between 4th and 5th Sem. During session break (6-8 weeks) (Credit-4) Field Visit/Industrial Project/ Final Year Research Project-I (Credit-2, for 3 years programmes)	28 (Excluding NCC)

		6th	1). Cryptography and Network Security (Th3+P1) 2). Web Technology (Th3+P1) 3). Machine Learning Techniques (Th3+P1)	1). Big Data (Th 4)/ 2). Compiler Design (Th 4)		SEC 3- MOOCs/NPTEL		NCC		Field Visit/Industrial Project/ Final Year Research Project-II (Credit-4, for 3 years programmes)	22 (Excluding NCC)

Note: For 04 years undergraduate programmes, research projects will be of 6 credits each in last 02 semesters.
*General Elective: Certificate will be provided to the students opted for NCC apart from degree.
** One SEC must be E&I and IPR (Can be through NPTEL or IPR can be from TIFAC, DST)
To be implemented from 2027-2028

M.C.A		7 th	C13- C14-	DSE 7- A/B +DSE-8	AECC 5-			NCC	VAC-1		23 (Excluding NCC)
		8 th	C15- C16-	DSE-9 A/B +DSE-10	AECC 6- Research &Publication Ethics	SEC 4- MOOCs (E&I/IPR)	GE -4 A/B	NCC	VAC-2	Seminar/Industrial Training/ Research (Credits-4)	26 (Excluding NCC)
		9 th	C17- C18-	DSE-11 A/B DSE-12			GE-4 A/B	NCC	VAC-3	Seminar/Industrial Training/ Research (Credits-4)	28 (Excluding NCC)
		10 th	C-19 C-20			SEC 5- MOOCs		NCC		Research Project (Credits -16)	20 (Excluding NCC)

IIMT UNIVERSITY MEERUT
Transforming Education System, Transforming Lives
UGC Approved Section 2(f) & 12B
NAAC Accredited with A GRADE

Format-2

IIMTU-NEP Implementation:										Format-2 BSC (CS)
Program	**Year**	**Semester (15 weeks)**	**Paper**	**Credit**	**Periods per Week**	**Periods (Hours) per Semester**	**Paper Title**	**Unit (Periods per semester**	**Prerequisite**	**Elective (For other faculty)**
CERTIFICATE COURSE	FIRSTYEAR(55 Cr.)	SEMESTER -I (26Cr.)	i) C1	3	3	40	'C' Programming	5		
			C1 (lab)	2	2	20	'C' Programming lab			
			C2	4	4	40	Mathematics -I	5		
			C3	3	3	40	Basics of Computer and Recent Trends	5		
			C3 (lab)	2	2	20	Basics of Computer and Recent Trends lab	5		
			ii) DSE1	4	4	40	ERP	5		
				3	3	40	M-Commerce	5		
			iii) AECC 1	2	2	30	English Communication	5		
				2	2	20	Office Automation Tools	5		
			iv) SEC1				Office Automation Tools Lab			
			v) VAC 1	2	2	30	Indian Ethos and Modern Management			
		SEMESTER – II (29 Cr.)	i) C4	3	3	40	Advance C Programming	5		
			C4 (lab)	2	2	20	Advance C Programming lab			
			C5	4	4	40	Mathematics -II	5		
			C6	3	3	40	Digital Electronics and Computer System Architecture	5		
			C6 (lab)	2	2	20	Digital Electronics and Computer System Architecture Lab	5		
			ii) DSE 2	4	4	40	Information System Artificial Intelligence	5		
			iii) AECC 2	4	4	40	Environment & Ecology	5		
				2	2	20	Environment & Ecology Lab			
			iv) SEC 2	2	2	30	IPR/E&I	5		

Note: Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.

Programme Outcome:	**Programme Specific Outcome:**
PO_1 PO_2 PO_3 ***Program Outcome and Program Specific Outcome – See Annexure – 1** **@List is attached in Annexure – 2**	PSO_1 PSO_2 PSO_3 PSO_4

Program me	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester)	Prerequi site	Elective (For other faculty)
DIPLOMA COURSE	SECOND YEAR (49 Cr.)	SEMESTER –III (24 Cr.)	i) C7	3	4	45	Data Structure and Algorithm using C	5		
			C7 (lab)	1	4	10	Data Structure and Algorithm using C lab			
			C8	4	4	40	Operating System	5		
			C9	3	4	40	DBMS	5		
			C9 (lab)	1	4	10	DBMS Lab			
			ii) DSE 3	4	4	40	Block Chain	5		
							Data Mining and Data Warehousing			
			iii) AECC 3	3	4	40	Human Values and Professional Ethics	5		
			iv) SEC 3	1	4	40	R-Programming	5		
				1	4	40	R-Programming Lab			
			v) VAC 2	3	4	40	Cyber Security	5		
Note: Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.										
		SEMESTER –IV (21 Cr.)	i) C10	3	4	45	OOPs using Java	5		
			C10 (lab)	1	4	10	OOPs using Javalab			
			C11	4	4	40	Software Engineering	5		
			C12	3	4	40	Computer Graphics	5		
			C12 (lab)	1	4	40	Computer Graphics Lab			
				4	4	40	IOT	5		
			ii) DSC 4	3	4	40	Mobile Application Development	5		
			iii) AECC 4	2	4	40	Professional Skills			
			iv) SEC 4				E&I	5		
				4			Summer internship in between 4th and 5th sem.			
Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.										

Programme Outcome:	**Programme Specific Outcome:**
PO_1	PSO_1
PO_2	PSO_2
PO_3	PSO_3
***Program Outcome and Program Specific Outcome – See Annexure – 1**	PSO_4
@List is attached in Annexure – 2	

Programme	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hour) per Semester	Paper Title	Unit (Periods per semester)	Prerequisite	Elective (For other faculty)
DEGREE COURSE	THIRD YEAR (42 Cr.)	SEMESTER – V (18 Cr.)	i) C13	4	4	45	Theory of Computation	5		
			C14	3	4	40	Python Programming	5		
			C14 (lab)	1	4	10	Python Programming Lab			
			C15	3	4	40	Computer Networks	5		
			C15 (lab)	1	4	40	Computer Networks Lab			
							Natural Language Processing	5		
			ii) DSE 5	4	4	40	Computer Vision			
			iii) VAC 3	2	4	40	Health and Wellness	5		
				4			Industrial Training/Survey/Research Project			
		SEMESTER –VI (16 Cr.)	i) C16	3	4	45	Web Technology	5		
			C16 (lab)	1	4	10	Web Technology Lab			
			C17	4	4	40	Cryptography and Network Security	5		
			C17	1	4	40	Cryptography and Network Security			
				3	4	40	Machine Learning Techniques	5		
			C18	1	4	10	Machine Learning Techniques Lab			
			C18 (lab)	4	4	40	Big Data	5		
			ii) DSE 6				Compiler Design			
				4			Industrial Training/Survey/Research Project			

Note: Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.

Annexure -1

Programme Outcome:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.

Programme Specific Outcome:

PSO1: The graduates are proficient in fundamental principles and methods of Computer Science, Mathematical and Scientific reasoning and are able to:

- Apply fundamental concepts of integration, differentiation, vector calculus, probability & statistics, and discrete mathematics.
- Design, create & evaluate algorithms appropriate to specific problems.

PSO2: The graduates have understanding for:

- Demonstrate capability for computers, computer network and server environments and there troubleshooting.
- Capacity to handle cloud computing environment and solutions.
- Well defined knowledge for solving problems of security and threats in information knowledge domain.

Format-3

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mathematics-I**
Course Code: 24BCS-CS102	**Title: Mathematics-I**

Course Objectives:
CO1: Remember the concept of matrices and apply for solving linear simultaneous equations.
CO2: Understand Sequence and series and test of convergence of different series.
CO3: Identify the application of partial differentiation and apply for evaluating maxima, minima, series and Jacobians.
CO4: Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface, and volume integrals.
CO5: Use Multiple Integrals and various Vector Integral techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Matrices:** Rank of matrix, Linear transformations, Hermitian and skew–Hermitian forms, Inverse of matrix by elementary operations, Linear dependence, Consistency of linear system of equations and their solution, Diagonalisation of a matrix, Eigen values and Eigen vectors, Caley – Hamilton theorem (without proof).	8
II	**Differential Calculus – I:** Leibnitz's theorem, Partial derivatives, Euler's theorem for homogeneous functions, Total derivatives, Change of variables, Curve tracing: Cartesian and Polar coordinates.	8
III	**Differential Calculus – II:** Taylor's and Maclaurin's Theorems, Expansion of function of several variables, Jacobian, Extrema of functions of several variables, Lagrange's method of multipliers (Simple applications).	8
IV	**Multiple Integrals:** Double and triple integrals, change of order of integration, Change of variables, Application of integration to lengths, Volumes and Surface areas – Cartesian and Polar coordinates, Beta and Gamma functions, Dirichlet's integral and applications.	8
V	**Vector Calculus:** Point function, Gradient, Divergence and Curl and their physical	8

	interpretations, Vector identities, Directional derivatives; Line, Surface and Volume integrals, Applications of Green's, Stoke's and Gauss divergence theorems (without proofs).	

Text Books:

1. E. Kreyszig, "*Advanced Engineering Mathematics*", JohnWiley& Sons
2. B. V. Ramana, "*Higher Engineering Mathematics*", Tata Mc Graw- Hill Publishing Company Ltd
3. R. K. Jain & S. R. K. Iyenger, "*Advance Engineering Mathematics*", Narosa Publishing House

Referential Books:

1. H. K. Dass, "*Introduction to Engineering Mathematics", S. Chand, New Delhi*
2. R. Wylie, "Advanced Engineering Mathematics", McGraw-Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report, Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Compute the rank and inverse of a matrix and solve system of linear equations.

CO2: Computation of Limits of Various Types of Functions, Continuity over an Interval, to find Intermediate Value Theorem and type of Discontinuities.

CO3: Understand the Derivatives, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation and Successive Differentiation.

CO4: Use of different theorems like Rolle's Theorem, Mean Value Theorem, Leibnitz Theorem, Partial Differentiation, Euler's Theorem.

CO5: Understanding of Integral as Limit of Sum, Riemann Sum, Fundamental Theorem of Calculus, Indefinite Integrals, Methods of Integration Substitution.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Basics of Computers and Recent Trends**
Course Code: 24BCS-CS103	**Title: Basics of Computers and Recent Trends**

Course Objectives:
CO1: To develop a foundational understanding of computer systems.
CO2: To provide students with a foundational understanding of the Internet, its components.
CO3: To introduce students to the fundamental concepts, and classifications of operating systems.
CO4: To provide students with a basic understanding of data communication principles.
CO5: To familiarize students with emerging technologies such as cloud computing, mobile computing, virtual and augmented reality, and the Internet of Things.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Basics of Computer:** Introduction to computer system, uses, types. Overview of Data Representation - Number systems and Coding Schemes (ASCII and UNICODE). Overview of Human Computer Interface - Relationship between Hardware and Software, Types of software, utility programs. Role of Computers in Business, Manufacturing, Media, Defense Services and Education.	8
II	**Overview of Internet and Its Uses:** Introduction to Internet. Role and importance of Internet, Overview of Web Server and Web clients like web browser or web applications, world wide web, Search Engines, E-mail, e-Library, e-business.	8
III	**Overview of Operating system:** Definition, Functions, Types, Classification, Elements of command based and CUI and GUI based operating system (DOS and WINDOWS)	8
IV	**Overview of Computer Network:** Introduction to Data communication, Modes of Communication (Simplex, Half-Duplex and Full- Duplex) Introduction to Computer Networks, Types of Computer networks (LAN, WAN and MAN), , Network Topologies.	8
V	**Recent Trends Technologies:** Cloud Computing - Meaning, Features, & Service models (IaaS, PaaS, SaaS), Advantages and Disadvantages, Mobile Computing - Meaning, Business Applications of Mobile computing, Virtual	8

	reality & Augmented Reality - Meaning and applications , Internet of Things (IoT) – Definition, Sensors, Applications of IoT, Industrial IoT.	

Text Books:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
2. Norton P., "Introduction to Computers", McGraw Hill Education.
3. Introduction to Information Technology by ITL Education Solutions Limited, second edition.

Reference:

1. Balagurusamy E., " Fundamentals of Computers", McGraw Hill
2. Thareja R., "Fundamentals of Computers", Oxford University Press.
3. Information Technology The breaking wave by Dennis Curtin Tata McGraw-hill edition
4. Introduction to Information Technology by P. Aksoy and L. DeNardis, Cengage Learning, 2006

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Students will be able to **identify and explain** the different types of computer systems.
CO2: Students will be able to **describe** key elements of Internet infrastructure
CO3: Students will be able to **compare** CUI and GUI operating systems.
CO4: Students will be able to **describe** various modes of communication and types of computer networks.
CO5: **Analyze** the characteristics and applications of cloud service models, mobile computing.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: ERP**
Course Code: 24BCS-CS104	**Title: ERP**

Course Objectives:

CO1: Understand what an enterprise is, how it can be managed with ERP?
CO2: To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
CO3: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 Theory 1 Hr = 1 credit

Units	Contents	No. of Lectures Allotted
I	What are Enterprise, Enterprise Resource Planning, Evolution and Structure of ERP, Basic ERP Concepts, Benefits and Risks of ERP**?**	**8**
II	ERP Implementation: Objectives, Introduction, ERP Implementation Methodology, Evaluation Of The Various ERP Packages.	**8**
III	ERP Business: Selection Criteria For ERP Packages, Implementation of ERP Packages	**8**
IV	ERP Market Place: Objectives, Introduction, Reasons for the Growth of The ERP Market.	**8**
V	**ERP & E-COMMERCE:** Understanding E-Commerce, Distinct Categories Of E-Commerce, Categories Of E-Commerce, and Relevance Of ERP With E-Commerce.	**8**

Text Books

1. Alexis Leon, "ERP Demystified", Tata McGraw–Hill Education.
2. Vinod Kumar Garg, N K Venkitakrishnan, "*Enterprise Resource Planning–Concepts and Practice",* PHI.

Referential Books

1. Joseph A. Brady, Ellen F. Monk, Bret J. Wagner, "Concepts in Enterprise Resource Planning", Course Technology Cengage Learning.
2. Rahul V. Altekar, *"Enterprise wide Resource Planning"*, Tata Mc Graw Hill.

Evaluation / Assessment Methodology	
	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to Understand what an enterprise is, how it can be managed with ERP?

CO2: Able to provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.

CO3: Able to focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.

CO4: Able to train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.

CO5: Able to aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: M-Commerce**
Course Code: 24BCS-CS105	**Title: M-Commerce**

Course Objectives:
CO1: Understand what M-Commerce is, how it can be managed, relation with E-Commerce?
CO2: To provide a contemporary and forward-looking on theory and practice of M- Commerce.
CO3: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: To train the students to develop the basic understanding of how M- Commerce, enriches the business organizations in achieving a multidimensional growth.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Units	Contents	No. of Lectures Allotted
I	**Introduction to Mobile commerce:** Definition, Scope of Mobile Commerce, Benefits and Limitations of M-Commerce, M-Commerce Framework, M-Commerce business Models, E-Commerce Vs M-Commerce, Impact of M-Commerce.	**8**
II	**Mobile commerce technology:** Types of Mobile Clients (Mobile Phones, PDAs, Laptop Computers, Vehicle-mounted Devices, Hybrid Devices etc.). Device Limitations: Considerations for user Interface and Application Design, Device Location Technology: GPS, Triangulation. Mobile Client Software: Mobile Device Operating Systems, Micro browsers, Mobile Device Communications Protocols: WAP, I-Mode, Mobile Device Page Description Languages, Mobile Device Application Software.	**8**
III	**Wireless communications of technology** Wireless Wide Area Network (WWAN) Technology: Cellular Systems, 2G (CDMA, TDMA, GSM), 2.5G (GPRS, EDGE), 3G (WCDMA/UMTS, CDMA2000), 4G, 5G. Wireless Local, Area Network (WLAN) Technology (Wi-Fi), Wireless Metropolitan Area Network (WMAN) Technology (WiMAX), Wireless Personal Area Network (WPAN) Technology	**8**

	(Bluetooth).	
IV	**M-Commerce applications:** Mobile Financial Services, Mobile Advertising, Mobile Payment, Mobile Ticketing, Mobile Product Location and Shopping, Mobile Business Services, Mobile Auction, Mobile Entertainment, Mobile Office, Mobile Distance Education.	**8**
V	**BUSINESS-TO-BUSINESS MOBILE E-COMMERCE** Enterprise Enablement, Email and Messaging, Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare), Field Sales Support (Content Access, Inventory), Asset Tracking and Maintenance/Management, Remote IT Support, Customer Retention (B2C Services, Financial, Special Deals), Warehouse. **Future of M- Commerce:** Future challenges, security, scalability.	**8**

Text Books

1 . Advanced E-Commerce and Mobile Commerce, Divakara Reddy N., Suman M., Himalaya Publication house Pvt. Ltd., ISBN 978-93-5202-139-0, New Delhi.
2. 2. MOBILE COMMERCE, Bandyopadhyay, Karabi, PHI Learning Pvt. Ltd., Delhi, Edition II

Referential Books

1. Brian E. Mennecke, Troy J. Strader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.
2. P. J. Louis, "M – Commerce Crash Course", McGraw – Hill Companies February 2001.
3. Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" Cambridge University Press March 200l.

Evaluation / Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to Understand what M-Commerce is, how it can be managed, relation with E-Commerce?
CO2: Able to provide a contemporary and forward-looking on theory and practice of M-Commerce.
CO3: Able to focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: Able to train the students to develop the basic understanding of how M- Commerce, enriches the business organizations in achieving a multidimensional growth.
CO5: Able to at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 2 **Theory: 2** **Practical: 0**	**Course: Office Automation Tools**
Course Code: 24BCS-CS106	**Title: Office Automation Tools**

Course Objectives:
CO1: To understand the basic knowledge of computer about its generationsand windows.
CO2: To apply the changing background of windows desktop, creating shortcut how to display toolbar.
CO3: To understand student will get the basic knowledge to create a file in MS word and format the files.
CO4: To understand The student will knowledge enter data in Excel, arrange data format data, how to use various functions sort information.
CO5: To understand create different types of Charts and Tables.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 40% Marks / 2 Credits (Internal + ESE)

L: 2
T: 0
P: 0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to File Formats with Types and Extension:**Text file, PDF file, JPG file, GIF file, ZIP file. **Introduction to Windows:** Introduction to Windows, Start Menu, Working with Programs, Customizing with Windows, Accessories of Windows, Introduction of software, Types of software.	4
II	**Introduction to Ms-WordWorking with Documents;** Opening & Saving files, editing text documents, Inserting, Deleting, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Formatting page & setting Margins. **Formatting Documents:** Setting Font styles, Font selection- style, size, color etc, Type face - Bold, Italic, Underline. **Setting Page style:** Formatting Page, Page tab, Margins, Layout settings, Border& Shading, Columns, Header & footer, Setting Footnotes. **Tools –** Spell Checks, Mail merge, Templates. **Creating Tables**: Table settings, Cell, Insert to cell, Borders, Alignments, Insertion, deletion, Merging, Chart in MS word, Table in MS word.	4
III	**Introduction to Microsoft Excel:** Spread Sheet & its Applications, Opening Spreadsheet, Menus - main menu, Formula Editing, Formatting, Toolbars, Using Icons, Shortcuts. **Working with Spreadsheets:** opening, saving files, setting Margins, Converting	4

	files to different formats (importing, exporting, sending files to others) **Entering & Deleting Data:** Entering data, Cut, Copy, Paste, Undo, Redo, Highlighting values, Find, Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols. **Formulas and Functions in Microsoft Excel:** Introduction, calculating with the help of Formulas andFunctions (SUM, AVERAGE, COUNT, MAX, MIN, IF), Row, Columns and Cells, Table Format, Sorting.	
IV	**Basic of Microsoft Power Point:** Introduction to presentation – Opening new presentation, Different presentation templates, Setting backgrounds, Selecting presentation layouts. **Creating a presentation**: Setting Presentation style, Adding text to the Presentation. **Formatting a Presentation:** Adding style, Color, Arranging objects, Adding Header & Footer, Slide Background, Slide layout.	4
V	**Microsoft Access:** Introduction of M.S Access, planning a database, StartingAccess, Create a new database.	4

Text Books:

1. E .Balagurusawy, V.Rajaraman "*Office Automation Tool"*.Mc Graw-Hill.
2. Kevin Pitch*"MS-Office Windows*". Dinesh Maidasani MS Office.

Reference

1. Priti Sinha ,Pradeep K. Sinha" *Office Automation Tool*".6th Edition

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand will get the basic knowledge of computer about its generations and types Windows.

CO2: Able to understand Changing background of windows desktop, creating shortcut how to display toolbar.

CO3: Able to understand Student will get the basic knowledge create a file in word and format the files.

CO4: Able to understand the student will the basic knowledge enter data in excel, arrange data format data, how to use various functions sort information.

CO5: Able to understand create different types of chart and Tables.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Feature Engineering**
Course Code: 24BCS-CS106-3	**Title: Feature Engineering**
Course Objectives:	
CO1: Extract useful features from data and convert them to features. CO2: Learn how to deal with infrequent, rare, and unseen categories. CO3: Learn to transform categorical variables into no. while capturing meaningful information. CO4: Learn to convert numerical variables into discrete ones. CO5: Learn techniques to pre-process data and build more powerful machine learning models.	
Nature of Paper: DSE	
Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)	
L: 4 T: 0 P: 0 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4 Hrs./Week= 4 Credits)	

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Feature Engineering, Importance of feature engineering, Evaluation of machine learning algorithm and Feature engineering procedures. Feature Understanding: Feature Improvement-cleaning datasets, Feature Selection-removing bad attributes, Feature construction, Feature Transformation, Feature learning	8
II	**Data Pre-processing and Missing Values:** Handling missing values, identification, imputation techniques (mean, median, regression-based), and impact on models. Basics of Feature Representation: Scalars and Vectors, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling).	8
III	**Encoding and Transformation Techniques Handling categorical variables:** one-hot encoding, label encoding, and target encoding, Handling text data: bag-of-words representation, TF-IDF encoding, and word embeddings. Numerical transformations: handling skewed distributions, logarithmic transformations, and scaling techniques. Binning and discretization of continuous variables.	8
IV	**Feature Selection:** Importance of Feature Selection in Machine Learning, Goals of Feature Selection, Classes of Feature Selection Methodologies. Effect of Irrelevant Feature, Univariate feature selection: statistical tests and feature importance, Recursive Feature Elimination, Stepwise Selection.	8

V	**Feature Transformations:** Intuition, Derivation, Linear Projection, Variance and Empirical Variance - Vector Formulation, General Solution of the Principal Components, Transforming Features, Implementing PCA, PCA in Action, Considerations and Limitations of PCA, Use Cases	8

Text Books:

1. Max Kuhn, Kjell Johnson, "Feature Engineering and Selection: A Practical Approach for Predictive Models" 1st Edition, Chapman & Hall/CRC Data Science Series, ISBN 13- 978- 1-138-07922-9.
2. Sinan Ozdemir, Divya Susarla, "Feature Engineering Made Easy", Packt Publishing,

Reference

1. Alice Zheng & Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for data scientist", Oreilly Publications

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Create new features from existing ones.
CO2: Impute missing data and encode categorical variables.
CO3: Transform numerical variables and change their distribution.
CO4: Perform discretization, remove outliers, and extract features from date & time.
CO5: Reduce dimensionality of data using PCA.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)**	**Year** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Basics of Data Analytics using Spread Sheet**
Course Code: 24BCS-CS107-4	**Title: Basics of Data Analytics using Spread Sheet**

Course Objectives:

CO1: To familiarize students with the fundamental concepts of data analytics, types of data, applications, and basic use of spreadsheet tools for data handling and analysis.

CO2: To enable students to acquire foundational skills in Microsoft Excel for entering, organizing, and managing worksheet data, performing basic operations, and applying simple formulas and functions effectively.

CO3: To equip students with the skills to create and use formulas, apply various functions, generate and format charts, and perform basic data analysis using spreadsheet tools.

CO4: To develop students' ability to visualize and analyze data by creating and customizing charts, and applying essential spreadsheet data analysis tools.

CO5: To enhance students' proficiency in advanced Excel functions for conditional analysis, data visualization, and automation using macros.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week= 4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Data Analytics :** Understanding data and its types (Structured, Unstructured, semi structured), What is Data Analytics, Type of Data Analytics, Application of data Analytics, Introduction to spread sheet tools (Excel, Google sheets)	8
II	**Introduction to Excel Basics** :- Entering and editing worksheet data, Performing basic worksheet operations, Use of simple arithmetic operations, Working with excel ranges and tables, Working with Formulas and Functions, Selecting Columns & Rows, Changing Column Width & Row Height, Auto fitting Columns & Rows, Hiding/Un hiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell.	8
III	**Creating Formulas.** Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum, using text functions to manipulate text, using date and time functions, Using formulas for financial analysis.	8
IV	**Spreadsheet Charts** Creating Charts, Different types of charts, Formatting	8

	Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table **Data Analysis** Sorting, Filter, Text to Column, Data Validation	
V	**Advanced Excel Functions for Data Analysis** Using formulas for Conditional Analysis, Use the IF function to evaluate a condition and return values based on the result, Apply the AND and OR functions to evaluate multiple conditions, perform conditional calculations (SUMIF, COUNTIF, AVERAGEIF), Data Visualization with Excel Demonstration of creation of a bar chart representing sales data for different months. Customize the appearance of a chart, including colors, fonts, titles, legends and axis labels, Making Macros Recording Macros, Running Macros, Deleting Macros	8

Text Books:

1. Excel 2019 bible, Alexander, M., Kusleika, R., & Walkenbach, J. (2018), John Wiley & Sons.
2. Excel data analysis for dummies, Nelson, S. L., & Nelson, E. C. (2014), John Wiley & Sons.
3. Data Analysis with Microsoft Excel, Berk, K. N., & Carey, P. (1998), Pacific Grove, CA: Duxbury Press.

Reference

1. Excel Data Analysis Modeling and Simulation., Hector, G. (2019), Spinger.
2. Microsoft Excel data analysis and business modelling, Winston, W. (2016), Microsoft press.

Evaluation/Assessment Methodology

	Max. Marks: 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course:

Course Learning Outcomes:

CO1: By the end of the course, students will be able to identify different types of data, explain data analytics concepts, recognize its applications, and perform basic data operations

CO2: Students will be able to create and edit worksheets, manage rows, columns, and ranges, apply basic arithmetic and functions, and format spreadsheet data for efficient presentation and analysis.

CO3: students will be able to apply formulas and functions for calculations and text manipulation, create and customize charts, and use spreadsheet features like sorting, filtering, and data validation for effective data analysis

CO4: By the end of the course, students will be able to design and format various chart types, modify chart elements, and perform data analysis using sorting, filtering, text-to-column, and data validation features.

CO5: By the end of the course, students will be able to perform conditional calculations using advanced functions, create and customize charts for data presentation, and automate repetitive tasks through recording and managing macros.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Office Automation Tools Lab**
Course Code: 24BCS-CS108P	**Title: Office Automation Tools Lab**

Course Objectives:
CO1: To understand Office tools course would enable the students in crafting professional word documents, excel spread sheets, power point presentations using the Microsoft suite of office tools.
CO2: To understand Familiarize the students in preparation of documents and presentations with office automation tools.
CO3: To understand Student will get the basic knowledge to create a file in MS word and format the files.
CO4: To understand Create different types of Charts and Tables.
CO5: To understand Changing background of windows desktop, creating shortcut how to display toolbar.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Understanding the desktop, taskbar, and start menu. Navigating files and folders, understanding different views, and managing files. How to create, rename, and organize folders. How to install new programs and remove unwanted ones.	1
2.	Create a Resume and other document using the table and shapes, Font color, Font size Text highlight color, Page number, Margins, Watermark, Page border, Page color, Align text.	1
3.	Create a flowchart using, a. Proper shapes like ellipse, arrows, rectangle, and parallelogram. b. Use grouping to group all the parts of the flowchart into one single object.	1
4.	Create a table using table menu with, a. At least 5 columns and 10 rows. b. Merge the first row into one cell. c. Merge the second row into one cell, then split the second row into three cells. d. Use proper table border and color	1
5.	Create a table using two columns, a. The left column contains all the short-cut keys and right side column contains the function of the short-cut keys. b. Insert a left column using layout option. Name the heading as Serial No.	1

6.	Opening Microsoft Excel Cells Filling in cells Selecting, Copying, Cutting, and Pasting Pasting Formulas Inserting or deleting row or columns Changing Column Width Formatting cells Changing fonts Saving an excel file	2
7.	Create a table "Student result" with following conditions. a. The heading must contain, Sl. No., Name, Mark1, Mark2, Mark3, Total, average and result with manual entry. b. Use formulas for total and average. c. Find the name of the students who has secured the highest and lowest marks. d. Round the average to the nearest highest integer and lowest integer (use ceiling and floor function respectively).	2
8.	Create a Student Table in MS-Access with the following features: a. Roll Number b. Student Name c. Class d. Marks in Subject 1, Subject 2, Subject 3 e. Total f. Average g. Result	2
9.	Create a Personal Information table in MS-Access with the following fields: a. First Name b. Middle Name c. Last Name d. Nationality e. Gender f. Temporary Address g. Permanent Address. Generate a Form and Report.	2
10.	Create a minimum of 10 slides with a slide theme appropriate for the topic.	2

Reference / Text Books:

- Office Automation Tools Lab/MS. Word:" by M .L.Humphrey" .
- Office Automation Tools Lab/MS power point/MS. Access:" byMOIRA Stephen,.Kevin Pitch.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Practical/Research Project Report Seminar On Research Project Report	25
5) ESE	-
Total:	**50**

Program Learning Outcomes:

CO1: Students will be able to develop to create the folder, files based on office automation tools.
CO2: Students will be able to understand create the resume and all function used in MS word.
CO3: Students will be able to understand create the Mark sheet and all function used in MS excel.
CO4: Students will be able to understand Create a Student Table in MS-Access with the following features.
CO5: Students will be able to understand Create a minimum of 10 slides with a slide theme appropriate for the topic.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Basics of Computers and Recent Trends Lab**
Course Code: 24BCS-CS109P	**Title: Basics of Computers and Recent Trends Lab**

Course Objectives:
CO1: To introduce the fundamental components of computer hardware, including input, output, processing, and memory devices, and their roles in a computer system.
CO2: To develop practical skills in using operating systems, including file management, executing DOS commands, and managing installed applications.
CO3: To enable students to create and manage online accounts, such as email and e-commerce portals, for communication and digital transactions.
CO4: To explore the hardware elements used in computer networking.
CO5: To examine real-world applications of cloud computing technologies.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical-2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Practical Allotted
1.	Demonstrate the Computer Hardware Components- Input devices (KB, Mouse, Scanner), Output Devices (Monitor, Printers, Speaker), Process Devices (Motherboard, Microprocessor) and Memory Devices (RAM, ROM, HDD, DVD)	1
2.	Create an E-mail Id account in various mail portal like Gmail, yahoo etc.	1
3.	Create an account in various E-business portal like Amazon, Flipkart etc.	1
4.	Search the e-library portal through search engine and create an account to access the various services of library.	1
5.	Practices the various DOS internal and external commands.	2
6.	Explore the entire desktop Explore the file manager. Create, rename, and organize files and folders. To install and uninstall programs.	2
7.	Demonstrate the Computer Network Hardware Components- Various types of network cables (Coaxial, Twisted pair), HUB, Switches (16 and 32 Port), Connectors (T-connector, USB connector)	2
8.	Explore the use of cloud computing in various cloud based applications like Data Storage, AWS, Social Media etc.	2

Reference / Text Books:	
1. Balagurusamy E., " Fundamentals of Computers", McGraw Hill 2. Thareja R., "Fundamentals of Computers", Oxford University Press. 3. Andrew ,S. Tanenbaum, Fifth Edition 4. An Essential Guide to windows 10. 5. DOS – The Complete Reference, Tata-McGraw Hill, 1997 Edition-4th.	
Evaluation/Assessment Methodology	
	Max. Marks:50
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Practical File, Research Project Report Seminar On Research Project Report 5) ESE	25 - - 25 -
Total:	**50**

Course Learning Outcomes:

CO1: Identify and describe the purpose and functions of various computer hardware components, including input, output, processing, and storage devices. *(Bloom: Understanding)*

CO2: Demonstrate the ability to perform basic operating system functions, such as navigating the desktop, managing files and folders, and using internal and external DOS commands. *(Bloom: Applying)*

CO3: Create and manage user accounts on email services (e.g., Gmail, Yahoo) and e-commerce platforms (e.g., Amazon, Flipkart), showing competence in digital identity management. *(Bloom: Applying)*

CO4: Explain the function and setup of common network hardware, including different types of cables, switches, and connectors, used in networking environments. *(Bloom: Understanding)*

CO5: Analyze how cloud computing is applied in services like online data storage, AWS infrastructure, and social media platforms, and describe its benefits and limitations. *(Bloom: Analyzing).*

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Problem solving techniques using 'C' Language**
Course Code: 24BCS-CS101	**Title: Problem solving techniques using 'C' Language**

Course Objectives:
CO1: Explain the needs of programming language.
CO2: Learn Conditional and Iterative Control Statements in 'C' language.
CO3: Students will be able to learn the basics of functions in 'C' language.
CO4: Students will be familiar with uses of an array.
CO5: Students will be familiar with File handling programs to perform read write operations and how to use functions in 'C' language.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to 'C' Language:** History, C Character Set, Tokens, Keywords, Constants, Identifiers, Variables, Data Types, Comments, Structures of 'C' Program. Assignment Operators, Expressions, Statements, Arithmetic Expressions. **Storage Classes:** Automatic, External, Static & Register.	8
II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, go to Statement, Loops (for, while, do-while) in C, Nested Loops, break and continue Statements.	8
III	**Functions:** Advantages of Functions, declaring a Function, defining a Function, calling a Function, Argument Passing – Call by Value, Call by Reference, Types of Functions, Recursion.	8
IV	**Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data from Array, Multi-Dimensional Arrays.	8
V	**File Handling:** Introduction, File Types- Text, Binary, The File Pointer, Opening a File, Closing a File, Reading and Writing a File, File Handling Functions: fgetc(), fputc(), fputs(), fgets(), fprintf(), fscanf(), fwrite(), fread(), fseek().	8

Text Books:
1. Stephen W. Sagman & Gail Taylor,"*MS-Office 2000For Windows*", Peachpit Press.

2. Balaguruswamy, "*Programming in ANSI C",* Tata Mc.Graw-Hill education.
3. YashwantKanetkar, *"Let us C",* BPB Publications

Reference

1. V. Rajaraman, "*Fundamental of Computers*", Prentice-Hall of India.
2. V Rajaraman, "*Computer Basics and C Programming*", PHI Learning
3. Ashok N. Kamthane, "*Programming in C*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand basic concepts of 'C' programming language.
CO2: Familiarize students with Conditional and Iterative Control Statement in 'C' language.
CO3: Students will be able to use functions in 'C' language.
CO4: Students will be able to solve problems with an Array.
CO5: Familiarize students with File Handling in 'C' language.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Problem solving techniques using 'C' Language Lab**
Course Code: 25BCS-CS107P	**Title: Problem solving techniques using 'C' Language Lab**

Course Objectives:
CO1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.
CO2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements.
CO3: Students will be familiar with the concept of Arrays.
CO4: Students will be able to develop a Program with Functions Operations.
CO5: Students will be familiar with File handling programs to perform read-write operations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L:0
T:0
P:2(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Write a program to display “hello world” in C.	1
2.	Write a program to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd.	1
3.	Write a program to check whether the entered year is a leap year or not (a year is a leap if it is divisible by 4 and divisible by 100 or 400.)	1
4.	Write a program to read a string and check for palindrome without using string-related functions (a string is a palindrome if its half is mirror by itself.	1
5.	Write a program to find the biggest among three numbers.	1
6.	Write a program to print a table of a given number.	1
7.	Write a program to print a factorial of a given number.	1
8.	Program to read two integer and two floating point numbers.	1
9.	Program to accept the marks of 5 subjects and finds the sum and percentage marks obtained by the student.	1
10.	Program to calculate the simple interest and compound interest (The Principal, Amount, Rate of Interest and Time are entered through keyboard).	1

11.	Program to calculate the area and circumference of a circle.	1
12.	Program that swaps values of two variables using a third variable.	1
13.	Program that swaps the values of two variables without using a 3rd variable.	1
14.	Program to calculate and print the area of triangle, where the three sides of the triangle is given as input.	1
15.	Program that checks whether the two numbers entered by the user are equal or not.	1
16.	Program to find whether a given number is even or odd.	1
17.	Write a Program to read two numbers and an operator (+, -, *, /) which performs the specified operation and display the result.	1
18.	Program to display the first N numbers.	1
19.	Program to print the sum of all numbers up to a given number.	1
20.	Program to print sum of even and odd numbers from 1 to N numbers.	1
21.	**Program** to demonstrate the use of **macros** using the #define preprocessor directive.	1
22.	Program that simply takes elements of the array from the user and finds the sum of these elements.	1
23.	Program to find the minimum and maximum element of the array.	1
24.	Write a C program that asks the user for their name and greets them with a welcome message	1
25.	Write a program to copy the content of one file to another file.	1

Reference / Text Books:

- The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie.
- C Programming: A Modern Approach" by K. N. King.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

PO1: Students can develop programs based on fundamental concepts of programming in C.
PO2: Students can solve problems based on Conditional and Iterative Control Statements.
PO3: Students can learn Complete Programming Concepts of Arrays.
PO4: Students can learn conceptual programming with Functions.
PO5: Students can perform File handling programs with read and write concepts

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject:- Mathematics -II**
Course Code: 24BCS-CS202	**Title: Mathematics -II**

Course Objectives:

1. Learning different methods to solve various types of differential equations.
2. Introducing series solutions such as power series methods for solving differential equations.
3. Familiarizing with Laplace transforms and their applications in solving the differential equations.
4. Learning to compute coefficients of Fourier series using integration techniques.
5. Understand the fundamental concepts of partial differential equations and their applications in different fields of science.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit (4 Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
1	**Differential Equations:** Linear differential equations of nth order with constant coefficients, Complementary function and Particular integral, Simultaneous linear differential equations, Solution of second order differential equations by changing dependent & independent variables, Normal form, Method of variation of parameters, Applications(without derivation).	8
2	**Series Solution and Special Functions:** Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.	8
3	**Laplace Transform:** Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.	8
4	**Fourier Series**: Euler's Formulae, Functions having arbitrary periods, Periodic functions, Fourier series of period 2π, Change of interval, Even and odd functions, Half range sine and cosine series.	6
5	**Partial Differential Equations:** Solution of first order partial differential equations by Lagrange's method, Solution of second order linear partial differential equations with constant coefficients, Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and	10

	heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.	

Text Books:-

1. H.K. Dass, "*Advanced Engineering Mathematics*", S. Chand & Company.
2. J.P Chauhan, "Mathematics", Krishna Publication.

Reference Books:-

1. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists", Reston Pub. Co.
2. Kenneth H. Rosen, "Discrete Mathematics and Its Applications: With
3. Combinatorics and Graph Theory", Tata McGraw Hill Education

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:-

1. Understand the nature and types of differential equations and to find the solutions with different methods.
2. Find the Series solutions of second order differential equations by different methods.
3. Apply the Laplace transforms and their applications to solve linear differential equations.
4. Understand the representation of periodic functions using Fourier series.
5. Solve various types of PDE's and explore its applications in different branches.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: II**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Digital Electronics and Computer System Architecture**
Course Code: 24BCS-CS203	**Title: Digital Electronics and Computer System Architecture**

Course Objectives:
CO1: Understand Fundamental Computer Organization Concepts.
CO2: Analyze Computer Arithmetic and Register Operations.
CO3: Explain CPU Organization and Control Unit Design.
CO4: Evaluate Memory and Input-Output Organization.
CO5: Understand Advanced Processing Concepts.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L:3
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Basic Functional units of Computers:** Functional units, basic Operational concepts, Flip Flops, Types of Flip Flops Number Systems, Logic Gates and Combinational Circuits, Bus structures. Software, Performance, Multiprocessors, Multicomputer. Data Representation: Signed number representation, fixed and floating-point Representations. Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms. Error detection and correction codes.	8
II	**Register Transfer Language and Micro Operations:** RTL- Registers, Register transfers, Bus and memory transfers. Micro operations: Arithmetic, Logic, and Shift micro-operations, Arithmetic logic shift unit. Basic Computer Organization and Design: Computer Registers, Computer instructions, Instruction cycle. Instruction codes, Timing and Control, Types of Instructions: Memory Reference Instructions, Input – Output and Interrupt.	8
III	**Central Processing Unit organization:** General Register Organization, Stack organization, Instruction formats, addressing modes, Data Transfer and Manipulation, Program Control, CISC and RISC processors Control unit design: Design approaches, Control memory, Address sequencing, micro program example, design of CU. Micro Programmed Control.	8
IV	**Memory Organization:** Semiconductor Memory Technologies, Memory hierarchy, Interleaving, Main Memory-RAM and ROM chips, Address	8

	map, Associative memory-Hardware organization. Match logic. Cache memory-size vs. block size, Mapping Functions-Associate, Direct, Set Associative mapping. Replacement algorithms, write policies. Auxiliary memory Magnetic tapes etc.	
V	**Input –Output Organization:** Peripheral devices, Input-output subsystems, I/O device interface, I/O Processor, I/O transfers–Program controlled, Interrupt driven, and DMA, interrupts, and exceptions. I/O device interfaces – SCII, USB Pipelining and Vector Processing: Basic concepts, Instruction level Parallelism Throughput and Speedup, Pipeline hazards.	8

Text Books:

1. Morris Manno, "Computer System Architecture", Pearson Education.
2. W. Stallings, "Computer Organisation and Architecture", Pearson Education.

Reference:

1. "Computer Architecture and Organization", 3rd Edition by John P. ayes,WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by i. William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry ii. F. Jordan, Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain the basic functional units of a computer, number systems, logic gates, combinational circuits, bus structures, and data representation methods.

CO2: Perform arithmetic operations using various algorithms and demonstrate register transfer language (RTL) and micro-operations in digital systems.

CO3: Describe CPU organization, instruction formats, addressing modes, instruction cycle, and design principles of hardwired and micro programmed control units.

CO4: Analyze memory hierarchy, cache mapping techniques, replacement policies, and different input-output transfer mechanisms including DMA and interrupt-driven I/O.

CO5: Evaluate performance improvement techniques such as pipelining, instruction-level parallelism, multiprocessors, multicomputer, and vector processing systems.

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme : Certificate **Class: BSc(CS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Digital Marketing**
Course Code- 24BCS-CS204	**Title: Digital Marketing**

Course Objectives

CO1. Understand the marketing in the digital era.
CO2. Understand the business drivers in the virtual world; such as social media, online branding, traffic building on web-site, ecommerce.
CO3. Understand the online tools for marketing.
CO4.To understand the contemporary digital revolution.
CO5. To Apply critical thinking and problem-solving skills to real-world digital marketing scenarios.

Nature of Paper: DSE 2

Minimum Passing Marks / Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0
Theory 1Hr = 1 credit

Units	Contents	No. of Lectures Allotted
I	Digital world: Marketing in the Digital Era, E-marketing. Building Website using Website/ Blog Foundations of analytics- Search engine optimization, Key Words, Key Word planner tools, SEO- One page and Off page Techniques: Indexing and Key word placing and content optimization.	8
II	Business Drivers in the Virtual World: Social media, Online Branding, Traffic Building, Web Business Models, E-commerce, E-marketing, Online Marketing, Online Consumer, Customer Relationship Management, Online Tools for Marketing	8
III	Contemporary Digital Revolution 5, Online Communities and Co-creation, The World of Facebook, Future of Marketing in gaming and Apps Engagement Marketing through Content Management, Online Campaign Management, Consumer Segmentation, Targeting, and Positioning using Online Tools, Market Influence Analytics in a Digital Ecosystem	8
IV	Email Marketing: Email marketing, Building an email list, Creating effective email campaigns, Email automation and segmentation, Email marketing metrics and analytics, , Content strategy and Planning Mobile Financial Services, Mobile Advertising, Mobile Payment, Mobile Ticketing, Mobile Product Location and Shopping, Mobile Business Services, Mobile Auction, Mobile Entertainment.	8

V	Automation in Insurance, Healthcare, Sales Support (Content Access, Inventory), Asset Tracking and Maintenance/Management, Remote IT Support, DIGITAL MARKETING PROMOTION: Types of Various Ad Formats: PPC, Banners, Video Ads, App Ads, Facebook advertising, Twitter Advertising, YouTube Advertising, LinkedIn Marketing. Affiliate Marketing, Influence marketing.	8

Text Books

1. Advanced E-Commerce and Mobile Commerce, Divakara Reddy N., Suman M., Himalaya Publication house Pvt. Ltd., ISBN 978-93-5202-139-0.
2. Digital Marketing Strategy: An Integrated Approach to Online Marketing, Simon Kingsnorth., second edition, ISBN: 0749484225, Publisher Kogan Page

Referential Books

1. Digital Marketing, Publisher: Oxford University Press Author: Vandana Ahuja
2. Digital Marketing Strategy, Implementation, and Practice, Dave Chaffey; Fiona Ellis- Chadwick: 11th Edition, Pearson
3. Seema Gupta: Digital Marketing, McGraw Hill Education (India) Private Limited.

Evaluation / Assessment Methodology

	Max. Marks 100
1. Class tasks/ Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	10
4. Research Project Report Seminar On Research Project Report	-
5. ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1. Able to understand the marketing in the digital era.
CO2. Able to understand the business drivers in the virtual world; such as social media, online branding, traffic building on web-site, ecommerce.
CO3. Able to understand the online tools for marketing.
CO4. Able to understand the contemporary digital revolution.
CO5. Able to understand critical thinking and problem-solving skills to real-world digital marketing scenarios

Format-3

IIMTU-NEPIMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Information System**
Course Code: 24BCS-CS205	**Title: Information System**

Course Objectives:

CO1: Understand the role of information systems in business operations and strategy.
CO2: Analyze and design information systems that meet organizational needs.
CO3: Gain familiarity with various types of information systems, such as ERP, CRM, and SCM.
CO4: Understand the ethical, legal, and social implications of information systems.
CO5: Explore emerging trends in information systems, such as cloud computing, big data, and cybersecurity.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Information Systems:** Definition and components of Information Systems, The role of IS in business and society, Overview of types of Information Systems, Information Systems in Organizations, Organizational structure and IS, IS for competitive advantage, Information systems management roles and structures.	8
II	**Information and communications technologies:** Communications technologies and networks, the internet. Data storage systems, files and databases. **Data and System Development:** Data Management, Database concepts, Data modeling and design, Introduction to SQL **Information Systems Development:** Information systems development approaches; life cycle, prototyping, incremental models. Systems analysis tasks, methodologies, modelling and agile methods. Data modelling. Systems implementation. System development life cycle (SDLC), Agile and Waterfall methodologies, Tools for IS development.	8
III	**Enterprise Systems:** Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supply Chain Management (SCM) **E-Business and E-Commerce:** E-Business models and strategies, E-Commerce platforms and technologies.	8
IV	**Cloud Computing and Big Data:** Introduction to cloud computing, Big Data technologies and analytics, Impact of cloud and big data on business, Open source software. Social networking.	8

	Cybersecurity and Ethical Issues: Cybersecurity fundamentals, Ethical and legal issues in IS, Data privacy and protection	
V	**Emerging Trends in Information Systems:** Artificial Intelligence and Machine Learning in IS, Blockchain technology, Internet of Things (IoT) and its impact on IS **Information Systems Strategy and Management:** IS strategy alignment with business strategy, IS governance and risk management, Future directions in IS management	8

Text Books:

- Laudon, K.C. and J.P. Laudon. Management Information Systems: Managing the Digital Firm. (New Jersey: Prentice Hall, 2019) sixteenth edition [ISBN 978-0135191798

Reference

- "Information Systems for Business and Beyond" by David T. Bourgeois.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar/Attendance	-
3) Assignments/TA	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcome

CO1: Able to identify role of information systems in business operations and strategy.
CO2: Design information systems that meet organizational needs.
CO3: Gain Knowledge and working with various types of information systems, such as ERP, CRM, and SCM.
CO4: Understand the ethical, legal, and social implications of information systems.
CO5: Able to work in emerging trends in information systems, such as cloud computing, big data, and cybersecurity.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Artificial Intelligence**
Course Code: 24BCS-CS206-1	**Title: Artificial Intelligence**

Course Objectives:
CO1: To understand about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: To study the concepts Propositional logics, predicate Logic.
CO3: To understand the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts.
CO4: To understand concepts of Prolog and Implement the Prolog Program.
CO5: To learning concepts of Expert system and Learning.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.= 1 Credit (4 Hrs./Week= 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).	**8**
II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, No deductive Inference Methods, Rules.	**8**
III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts	**8**
IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/output and Streams, Databases, Implementation of Concepts in Prolog.	**8**
V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition, Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Example-Induction, Explanation Based	**8**

	learning.	

Text Books:

1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. Dan W. Patterson, *"Introduction to Artificial Intelligence& Expert Systems"*, PHI.
2. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.

Referential Books:

1. Stuart J. Russell &Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall.
2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: mathematics, statistics, and Computer programming.

Course Learning Outcomes:

CO1: Learnt about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: Learnt study the concepts Propositional logics, predicate Logic
CO3: Learnt the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO4: Learnt concepts of Prolog and Implement the Prolog Program.
CO5: Learnt concepts of Expert system and Learning.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Subject: Digital Electronics and Computer System Architecture Lab**
Course Code: 24BCS-CS207P	**Title: Digital Electronics and Computer System Architecture Lab**

Course Objectives:
CO1: Develop a fundamental understanding of digital electronic circuits and systems.
CO2: Provide hands-on experience in designing, building, and testing digital circuits using logic gates, flip-flops, counters, and other basic digital components.
CO3: Familiarize students with different types of digital electronic devices, such as multiplexers, decoders, encoders, and comparators.
CO4: Enhance skills in designing and implementing combinational and sequential circuits to solve practical problems.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=2Credits)

Unit	Contents	No. of Lectures Allotted
I	Implementation of the given Boolean function using logic gates in both sop and pos forms.	2
II	Verification of state tables of RS, JK, T and D flip-flops using NAND & nor gates.	2
III	Implementation and verification of decoder/de-multiplexer and 4 encoder using logic gates.	2
IV	Implementation of 4x1 multiplexer using logic gates.	2
V	Design and verify the 4-bit synchronous counter.	2
VI	Design and verify the 4-bit asynchronous counter.	2
VII	To design and verify operation of half adder and full adder	2
VIII	To design and verify operation of half subtractor.	2

Reference / Text Books:
1. Floyd," Digital Fundamentals", PHI.
2. Morris Mano, "Digital Design", Prentice Hall of India.
3. Tocci.R.J, "Digital Systems-Principles .1 Applications"-Prentice I of India.
4. B. R. Gupta and T.Singhal, "Digital Electronics" 4th Edition, S.K Kataria& sons, India.
5. Fletcher.W.I., "An EngineeringApproach to Digital Design", Prentice Hall of India.
6. Millman&Halkias ,"Integrated Electronics".

7. V.K.PURI, "Digital Electronics", TMH.	
Evaluation/Assessment Methodology	
	Max. Marks: 50
1. Class tasks/ Sessional Examination	25
2. Presentations /Seminar	-
3. Assignments	-
4. Practical File /Research Project Report Seminar On Research Project Report	-
5. ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Understand the basic principles and concepts of digital electronics, including logic gates, Boolean algebra, and binary number systems.
CO2: Demonstrate proficiency in designing, building, and testing digital circuits using various digital components.
CO3: Analyze and troubleshoot digital circuits using appropriate testing and measurement tools, such as oscilloscopes and logic analyzers.
CO4: Design and implement combinational circuits, such as adders, multiplexers, and encoders, to solve specific problems.
CO5: Design and implement sequential circuits, such as flip-flops, counters, and shift registers, for various applications.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)**	**Year: I** **Semester: II**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Data Structures**
Course Code: 25BCS-CS201	**Title: Data Structures**

Course Objectives:
CO1: Remember a brief description of Array data structures.
CO2: Analyze performance of Linked List and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.	8
II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists with implementation, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists.	8
III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deque, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal; Traversal of Binary Trees; Introduction of Binary Search Tree(BST).	9

	Graphs: Introduction, Terminology, Representation.	
V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Merge Sort, Heap Sort, Linear Search, Binary Search; Introduction of Hashing.	8

Text Books:

1. Aaron M. Tenenbaum**, "***Data Structures Using C***",** Pearson Education.
2. Samir Kumar Bandyopadhyay, K. N. Dey, "*Data Structures Using C",* Pearson Education.
3. Lipschutz (Schaum's Series), "*Data Structure with C",* Tata McGraw Hill Education.

Reference:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*", Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. 3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

	Evaluation/Assessment Marks
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: ***Problem Solving using C***

Program Learning Outcomes:

PO1: Remember the need of data structure for writing efficient Programs.
PO2: Analyze the performance of linked list with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structures.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Program: Certificate **Class: BSc(CS)**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Structures Lab**
Course Code: 25BCS-CS206P	**Title: Data Structures Lab**

Course Objectives:
CO1: Remember a brief description of Array data structures.
CO2: Analyze performance of Linked List and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Write down difference between Data Type and Data Structure.	1
2.	Differentiate Linear and Non-Linear Data Structure.	1
3.	List operations on Data structure.	1
4.	Explain Linear and multidimensional array with memory implementation in primary memory including concept of row and column major.	1
5.	Give a brief overview of Sparse matrix its memory storage, types and examples.	1
6.	How do traversal work for forward and backward direction in doubly link list.	1
7.	WAP in C language for the Array Implementation of Stack.	1
8.	Write the C function for Push and Pop operations.	1
9.	Represent and analyze the concept of Stack with Link list representation.	1
10.	What are the various operations performed on the Queue?	1
11.	Write an algorithm to insert an element in a circular queue.	1
12.	Explain the different types Graph representations?	1
13.	Write down the Heap sort and give its worst case, best case and average case analysis.	1

14.	Write down the selection sort and give its worst case, best case and average case analysis.	1
15.	What is multilevel indexing in terms of tree indexes?	1
16.	What are the two methods of binary tree implementation? Explain them.	1
17.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.	1
18.	What is multilevel indexing in terms of tree indexes?	1
19.	How many passes are required for the elements to be sorted in quick sort? Explain in detail.	1
20.	Write down the function to insert an element into a queue, in which the queue is implemented as an array.	1
21.	WAP in C language for the Array Implementation of Stack.	1
22.	Write the routine to insert a element onto a queue.	1
23.	Write the complete concept of Linear Search.	1
24.	What are the applications of queue? Explain evaluation of Batch processing.	1
25.	How do you evaluate the Postfix, Prefix and Infix Expressions.	1

Reference / Text Books:

- Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
- E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
- R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

PO1: Remember the need of data structure for writing efficient Programs.
PO2: Analyze the performance of linked list with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structures.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme:BSc/ BA/BBA/BCA/BTech Certificate/Diploma/Degree/All UG Programme	**Year: I** **Semester: II**
Credits: 5 **Theory: 4** **Practical: 1**	**Course: Environment and Ecology**
Course Code: NHU-NPR-112 **NHU-NPR-112P**	**Title: Environment and Ecology** **Environment and Ecology**

Course Objectives:

Subject comprised of various fields of Environmental science and their applications for the mankind. It meets the local to global requirement.

CO1: To appreciate the historical context of human interactions with the environment and to gain insights into the international efforts to safeguard the Earth's environment and resources.

CO2: To understand the concept of natural resources, identify types of natural resources, their distribution and use with special reference to India.

CO3: To develop a critical understanding of the environmental issues of concern

CO4: To describe the main types of ecosystems and their distribution in India and the world and to explain major conservation strategies taken in India.

CO5: To develop an understanding of pollution, its types and Control measures.

CO6: To gain a comprehensive knowledge of climate change, its science and response measures and to have an overview of national and global efforts to address climate change adaptation and mitigation.

CO7: To Explain major conservation strategies taken in India.

CO8: To Sensitize themselves to adverse health impacts of pollution.

Nature of Paper: AECC

Minimum Passing Marks/Credits: 40% Marks / 4 Credits
50% Marks / 1 Credits

L: 4
T: 0
P: 1(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Unit	Contents	No. of Lectures Allotted
I	Humans and the Environment: The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment, Indic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. Environmental Ethics and emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome-Limits to Growth; UN Conference on Human Environment 1972; World Commission	**04**

	on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.	
II	Natural Resources and Sustainable Development:Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. Biotic resources: Major type of biotic resources-forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges. Water resources: Types of water resources-fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water. Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources-solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.	**08**
III	Environmental Issues-Local, regional & Global: Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Pollution: Impact of sectoral processes on Environment;Types of Pollution- air, noise, water, soil, thermal, radioactive ;municipal solid waste, hazardous waste; trans boundary air pollution; acid rain; smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Climate change. Disasters -Natural and Man-made (Anthropogenic)	**08**
IV	Conservation of Biodiversity & Ecosystem: Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics• forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.	**08**
V	Environmental Pollution & Health: Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment;	**08**

	Definition of pollution; Point sources and non-point sources of pollution. Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants- carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.	
VI	Climate change: impacts, adaptation & mitigation: Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions- past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change. Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCs); Climate justice.	**08**
VII	Environment management: Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 5 lA (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001. Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis. Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling/Ecomark scheme.	**08**
VIII	Environmental Treaties and Legislation: An overview of instruments of international cooperation; bilateral and multilateral agreements;	**08**

	conventions and protocols; adoption, signature, ratification and entry into force; binding and non• binding measures; Conference of the Parties (COP). Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgements Major International organisations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.	

Reference / Text Books:

1. A text book of Ecology and Environment, P.C. Joshi & Namita Joshi, Himalaya Publishing House, Mumbai
2. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
3. Ecology and Environment, H.R. Singh and Neeraj Kumar, Rastogi Publication.
4. Fundamentals of Ecology, E.P. Odum, W.B. Saunders Co., Philadelphia.
5. Essentials of Ecology & Environmental Science, S.V.S. Rana, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Fisher, Michael H. (2018) An Environmental History of India-From Earliest Times to the Twenty-First Century, Cambridge University Press.
7. Wildlife Biology. Rajesh Gopal. Approved By MoEF, New Delhi.

If the course is available as Generic Elective then the students of following departments may opt it.
NO

Prerequisite: Intermediate/Basic knowledge of life science

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	16
2) Presentations /Seminar/Attendance	-
3) Assignments	5
4) Research Project Report Seminar On Research Project Report	4
5) ESE	75
Total:	**100**

Prerequisites for the course: Knowledge of Basics of Environment and Ecology (Intermediate level)

Course Learning Outcomes:

CLO1**:** Student will come up with the knowledge of field Environmental management as well as Sustainable development and benefit of mankind.

CLO2**:** Student will come up with the knowledge of Environment management.

CLO3**:** Student will come up with the knowledge of Environmental Science in cleaning the environment.

CLO4: Student will be Explain sustainable development, its goals, targets, challenges and global strategies for sustainable development.

CLO5:Student will be develop a critical understanding of the environmental issues

CLO6: The overall course outcome focused on the role of Environment management in human welfare.

CLO7: Student will be Explain major conservation strategies taken in India.

CLO8: Student will be able Sensitize themselves to adverse health impacts of pollution.

Instructional Method and Pedagogy

1. Preconditioning of the course and its blueprint shall be discussed in the beginning of the course.
2. Various teaching aids are used for smooth conduction of Lectures.
3. 75% attendance in academic sessions is mandatory.
4. Assignments shall be given at the end of each unit/topic. Extempore activity can also be organized on various topics.
5. PPT presentation method is also incorporated in teaching.
6. Case-study based learning will also be used.
7. Promotion of Ex-situ and In-situ learning.
8. Teaching-learning via organizing seminars, guest lectures, invited talks, symposium etc.
9. Identification of slow and fast learners also done during the course commencement.
10. For Slow learners, there is a provision of arrangements of extra classes/weakened classes/remedial classes for their improvement in academics. .
11. For fast learner students, extra exposure to field visit, guest lectures on advanced topics are incorporated.

PRACTICALS

NHU-NPR-112P: Environment and Ecology Lab

Marks: 50 (35 + 15) **Duration: 30 hours (1 credits)**

Case studies and fieldwork

The students are expected to be engaged in some of the following or similar identified activities:

1. Discussion on one national and one international case study related to the environment and sustainable development.
2. Field visits to identify local/regional environmental issues make observations including data collection and prepare a brief report.
3. Participation in plantation drive and nature camps.

4. Documentation of campus biodiversity. 5. In-situ and Ex-situ Co**nservation Methods of Biodiversity.**			
ASSESSMENT FOR PRACTICAL			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Lab Performance/ Filed Work	5	Major Experiment/ Case studies	8
Quiz/ Env. Diary	5	Minor Experiment/ Case studies	6
Charts/ Model	5	Spotting	10
-	-	Viva	6
-	-	Record	5
Total	**15**	**Total**	**35**

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Data Structure and Algorithms using 'C'**
Course Code: 25BCS-CS301	**Title: Data Structure and Algorithms using 'C'**

Course Objectives:
CO1: Remember an introduction of major algorithms and brief description of Array data structures.
CO2: Analyze performance of Linked List algorithms and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue algorithm and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.	8
II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists.	8
III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deque, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal; Traversal of Binary Trees; Application of Binary Trees; Binary Search Tree (BST), Insertion and Deletion in BST, B-Tree.	8

V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Merge Sort, Heap Sort, Linear Search, Binary Search and Hashing.	8

Text Books:

1. Aaron M. Tenenbaum, "Data Structures Using C", Pearson Education.
2. Samir Kumar Bandyopadhyay, K. N. Dey, "Data Structures Using C", Pearson Education.
3. Lipschutz (Schaum's Series), "Data Structure with C", Tata McGraw Hill Education.

Reference

1. Robert Kruse, C. L.Tondo, "Data Structures and Program Design in C" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "Fundamentals of Data Structures", Galgotia Publications.
3. R. S. Salaria, "Data Structures & Algorithms", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

	Evaluation/Assessment Marks
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: ***Problem Solving using 'C'***

Program Learning Outcomes:

PO1: Remember the need of data structure and Algorithms for writing efficient Programs.
PO2: Analyze the performance of linked list algorithms with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structure Algorithm.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Program: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Structure and Algorithms using 'C' Lab**
Course Code: 25BCS-CS301P	**Title: Data Structure and Algorithms using 'C' Lab**

Course Objectives:
CO1: Remember an introduction of major algorithms and brief description of Array data structures.
CO2: Analyze performance of Linked List algorithms and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue algorithm and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	What is an algorithm?	1
2.	Write down difference between Data Type and Data Structure.	1
3.	Differentiate Linear and Non-Linear Data Structure.	1
4.	List operations on Data structure.	1
5.	Explain Complexity.	1
6.	Define Big 'O notation.	1
7.	Define Time space Tradeoff.	
8.	Declare and Initialize Linear array.	1
9.	Write 4*4 sparse matrix.	1
10.	Write about Linked List.	1
11.	Define Data Structure, its Types and their Brief Explanation.	1
12.	What are the measures of an efficiency of an algorithm? Explain.	1
13.	Explain Linear and multidimensional array with memory implementation in primary memory including concept of row and column major.	1
14.	What do you understand by Insertion and deletion in Linear array, explain their Algorithms.	1
15.	Give a brief overview of Sparse matrix its memory storage, types and	1

	examples.	
16.	What do you understand by complexity of an algorithm? Write down Time and Space complexity and Explain time space trade-off.	1
17.	Write an algorithm for List Creation and Traversal.	1
18.	Explain node deletion algorithms for doubly link list	1
19.	Explain the different types Graph representations?	1
20.	How many passes are required for the elements to be sorted in insertion sort? Explain in detail.	1
21.	What are the two methods of binary tree implementation? Explain them.	1
22.	Write an algorithm for Depth First Search and explain steps of algorithm with suitable example.	1
23.	Explain the situation for collision and overflow area.	1
24.	Write an algorithm for Breapth First Search and explain steps of algorithm with suitable example.	1
25.	Explain the steps of deletion in BST.	1
26.	What is multilevel indexing in terms of tree indexes?	1
27.	What are the two methods of binary tree implementation? Explain them.	1
28.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.	1
29.	Write an algorithm to split a node in a B-Tree.	1
30.	Explain the differences between AVL Tree and BST.	1
31.	Explain the Prims algorithm with suitable example.	1
32.	How many passes are required for the elements to be sorted in quick sort? Explain in detail.	1
33.	Write an algorithm for Bellman Ford and explain some steps with suitable example.	1
34.	Write an algorithm Warshal algorithm and apply the steps of algorithm using suitable example.	1
35.	Explain the Straseen's Algorithm and apply the steps with suitable example.	1
36.	Explain all Greedy Programming approaches.	1
37.	Explain all pair shortest path with an example.	1
38.	Explain Longest Common Sub-Sequence Greedy Programming with an example.	1
39.	Write down the merge sort algorithm and give its worst case, best case and average case analysis.	1
40.	Write down the quick sort algorithm and give its worst case, best case and average case analysis.	1

Reference / Text Books:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*", Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology	
	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Learning Outcomes:

CO1: Remember the need of data structure and Algorithms for writing efficient Programs.
CO2: Analyze the performance of linked list algorithms with its versatile applications.
CO3: Develop and analyze real time application programs with concept of Stack and Queue.
CO4: Remember the conceptual and practical implementation of Major Tree Data Structure Algorithm.
CO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.PO3: Students can learn Complete Programming Concepts of Arrays.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Operating System**
Course Code: 25BCS-CS302	**Title: Operating System**

Course Objectives:

1. Analyze and evaluate the structure, functions, and types of operating systems, including their components and services.
2. Analyze and evaluate the functioning of processes and process scheduling in operating systems, including process states, context switching, threads, and scheduling algorithms.
3. To Analyze and evaluate process synchronization and deadlock handling techniques.
4. To enable students to understand and analyze memory management techniques including logical and physical address spaces, paging, segmentation, fragmentation, and virtual memory concepts.
5. Apply and analyze the concepts of file systems, disk, and I/O management to design and evaluate efficient storage and input/output subsystems in an operating system.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0
Theory - 1 Hr. = 1 Credit
Credit (4 Hrs./Week = 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Overview of Operating Systems**: Definition of Operating System, Types of Operating Systems-Batch, Time-Sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, OS Operations, OS Services, role of an Operating system as a resource manager, Spooling, System Calls and its types, Kernel, Shell, Device drivers, OS Structures-Layered, Monolithic, Microkernel Operating Systems.	8
II	**Processes:** Definition of Process, processes address space, Principle of Concurrency, Process States, Operations of Processes, Process State Transitions, Process Control Block, Context Switching, processes involved in context switching, Threads and their management, advantages of threads, types of threads, Concept of Multithreads **Process Scheduling:** Scheduling Objectives, Scheduling criteria, Preemptive and Non-Preemptive Scheduling, Types of Schedulers, Difference between Long term and short-term Scheduler, Dispatcher, Scheduling Criteria, Scheduling Algorithms, Multi-processor Scheduling.	8
III	**Process Synchronization:** Mutual exclusion, Critical section**,** Critical Section Problem, Two Process Solution, Semaphores, Classical Problem of Synchronization- Bounded Buffer Problem, Producer Consumer Problem and Dinning Philosopher Problem.	8

	Deadlock: Deadlock Characterizations, Conditions for deadlock, Resource Allocation Graph, Safe state, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Differentiate between deadlock prevention and avoidance, Deadlock Detection, Recovery from Deadlock.	
IV	**Memory Management:** Requirement of memory management, Logical versus Physical Address Space, Swapping, Paging, Fragmentation and its types, Compaction, Segmentation **Virtual Memory:** Virtual Memory and its advantages, Hardware and Control Structures, Demand Paging and its advantages, Page Fault, Page Replacement, Page-Replacement Algorithms, Thrashing, Causes of thrashing.	8
V	**File System**: File, Directory, File attributes, File operations, Types of files, Access Methods, Allocation Methods, File System Structure, Directory Structures and Protection, Free-Space Management. **Disk Management:** Disk Structure, Disk Scheduling Algorithm, Swap-Space Management. **I/O Management:** Principles of I/O Hardware-I/O devices, Types of Devices, Buffering and its types, Pooling, Device Controllers, Interrupt Handlers, Direct Memory Access.	8

Text Books:

1. Silberschatz and Galvin, "*Operating System Concepts*", John Wiley & Sons.
2. "Principles of Operating Systems" Author: Brian L. Stuart.
3. "Understanding Operating Systems" Authors: Ann McHoes, Ida M. Flynn.
4. Systems: Internals and Design Principles "Author: William Stallings **"**Operating.

Reference

1. Madnick& Donovan, "*Operating Systems*", Tata McGraw Hill.
2. Modern Operating Systems
   Author: Andrew S. Tanenbaum
3. Operating Systems: Internal and Design
   - Principles
   - Author: William Stallings

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Basic knowledge of Operating System and its working.

Course Learning Outcomes:

CO1. Students will be explaining the fundamental concepts, types, operations, and structures of operating systems, and apply this knowledge to identify the role of the OS in managing system resources and processes.

CO2. Students will be able to analyze and apply key operating system concepts related to process management and scheduling, including process states, process control blocks, context switching, thread management, and various scheduling algorithms, to design efficient and concurrent process scheduling systems in multiprocessor environments.

CO3. Students will be able to analyze and apply concepts of process synchronization and deadlock management, including critical sections, semaphores and deadlock characterization, prevention, avoidance, detection, and recovery techniques, to design and evaluate concurrent systems that ensure safe and efficient resource allocation.
CO4. Students will be able to analyze and evaluate various memory management techniques, including logical and physical address mapping, paging, segmentation, and virtual memory concepts, to effectively manage memory resources and optimize system performance.
CO5. Students will learn and explain the structure and management of file systems, disk management techniques, and I/O management principles, including device handling and data transfer methods, to effectively design and optimize operating system components.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 1 **Theory; 0** **Practical: 1**	**Course: Operating System Lab**
Course Code: 25BCS-CS302P	**Title: Operating System Lab**

Course Objectives:
CO1: To Implement the Banker Algorithm using C program
CO2: To implement various Page Replacement Algorithms.
CO3: To implement CPU Scheduling Algorithms and memory management algorithms.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write C programs to implement the FIFO (First-In-First-Out) Page Replacement Algorithm.	2
II	Write C programs to demonstrate Creating a New Process Using fork ().	2
III	Write C programs to implement the SJF CPU Scheduling Algorithms.	2
IV	Write C programs to simulate CPU scheduling algorithms: SJF and Round Robin to calculates waiting time and turnaround time for processes.	2
V	Implement the Contiguous File Allocation Strategies using C programs.	2
VI	Write C programs to simulate solutions to Classical Process Synchronization Problems.	2
VII	Write C programs for the implementation of SCAN disk scheduling algorithm.	2
VIII	Write a C program to implement Bankers Algorithm.	2

Reference / Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7 the edition, Wiley India Private Limited, New Delhi.
2. "Principles of Operating Systems" Author: Brian L. Stuart.
3. "Operating Systems: Internals and Design Principles "Author: William Stallings.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-

5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Identify the performance of various page replacement algorithms.
CO2: Develop banker algorithm for deadlock avoidance.
CO3: Choose the best CPU scheduling algorithm for a given problem instance.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Database Management System**
Course Code: 25BCA-303	**Title: Database Management System**

Course Objectives:

CO1: Define the key concepts of a Database Management System (DBMS) and its components, comparing it with traditional file systems.
CO2: Apply relational data model concepts to real-world database scenarios, identifying and differentiating between primary, candidate, foreign, and super keys.
CO3: Execute SQL queries to manipulate and retrieve data, utilizing various SQL commands (INSERT, UPDATE, DELETE, SELECT) and aggregate functions.
CO4: Evaluate the use of joins, Define key terms Analyze functional dependencies and apply normalization techniques to ensure data integrity.
CO5: Evaluate transaction systems by analyzing serializability, recoverability, and deadlock handling in database environments

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Data Base:** Introduction, Database System vs File System, Characteristics of DBMS, Advantages & Disadvantages of DBMS, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Overall Database Structure. Data Modelling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints.	8
II	**Relational data Model & Keys:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints. Keys, Concepts of Super Key, Candidate Key, Primary Key, Foreign Key, Generalization, Aggregation and Reduction of an ER Diagrams to Tables.	8
III	**Introduction to SQL:** Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views, and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, and Unions, Intersection, Minus, Cursors, Triggers and Procedures in SQL/PL SQL.	8
IV	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join	8

	decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.	
V	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System	8

Text Books:

1. Korth, Silbertz, Sudarshan," Database Concepts", Mc Graw Hill.
2. Date C J, "An Introduction to Database Systems", Addision Wesley.
3. Elmasri, Navathe, "Fundamentals of Database Systems", Addision Wesley.
4. O'Neil, "Databases", Elsevier Pub

Reference

1. Ramakrishnan, "Database Management Systems", McGraw Hill.
2. Leon & Leon, "Database Management Systems", Vikas Publishing House.
3. Bipin C. Desai, "An Introduction to Database Systems", Gagotia Publications.
4. Majumdar& Bhattacharya, "Database Management System", Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Students will be able to identify and define core database system components such as data models, schemas, instances, and the concept of data independence.
CO2: Students will be able to demonstrate understanding of relational model, and use of keys.
CO3: Students will demonstrate proficiency in SQL by executing complex queries to manipulate and retrieve data, incorporating aggregate function.
CO4: Students will be able to assess and optimize the use of joins, subqueries, and views in SQL queries.
CO5: Students will be able to analyze data models for functional dependencies and normalize database schemas up to BCNF, ensuring minimal redundancy and maintaining data integrity in database design.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Base Management System Lab**
Course Code: 25BCS-CS303P	**Title: Data Base Management System Lab**

Course Objectives:
To learn the student should be made to:
CO1: Foundation knowledge in database concepts, technology, and practice to groom students into well-informed database application developers.
CO2: Be familiarized with a query language.
CO3: Have hands on experience on DDL Commands.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Creation of a database and writing SQL queries to retrieve information from the database.	2
II	Performing Insertion, Deletion, Modifying, Updating and Viewing records based on conditions.	2
III	Perform the following: a. Viewing all databases, creating a Database, viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting b. Records in a Table, Saving (Commit) and Undoing (rollback).	2
IV	Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, backing up / restoring a Database.	2
V	For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer Join Sub queries-With IN clause, With EXISTS clause.	2
VI	For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting from view.	2
VII	Write a Pl/SQL program using FOR loop to insert ten rows into a database	2

	table.	
VIII	Given the table EMPLOYEE (Emp No, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.	2

Reference / Text Books:

1. Fundamentals of Database System ByElmasari& Navathe, 7th Edition, 2018, Pearson Education.
2. Database System Concepts by Silberschatz, Korth& Sudarshan, 6th Edition, 2019, McGraw-Hill Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Design and implement a database schema for a given problem-domain

CO2: Populate and query a database

CO3: Create and maintain tables using PL/SQL.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Blockchain**
Course Code: 25BCS-CS304-1	**Title: Blockchain**

Course Objectives:
CO1: Study and understand basic concepts of Blockchain basics.
CO2: Learn about various consensus protocol used in Blockchain.
CO3: Evaluate and learn about cryptocurrency.
CO4: Learn about various security features of Blockchain.
CO5: Evaluate Blockchain Technology used in different areas.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction of Blockchain**: Foundation of Blockchain, Features of Blockchain, Need of Blockchain, Component of Blockchain, Public blockchains, Permissioned blockchains, Private blockchains, The Structure of Blockchains, The Blockchain Life Cycle, Blockchain architecture, Blockchain-as-a-Service.	8
II	**Consensus Algorithm:** Introduction of Consensus, Proof of Work (PoW), Proof of State (PoS), Proof of Authority (PoA), Hash functions, Merkle Tree, Nonce in Blockchain.	8
III	**Cryptocurrency:** Blockchain version; Currency, Smart Contracts, Dapps, History of the Bitcoin Blockchain, History of the Ethereum Blockchain, History of the Ripple Blockchain, Myth about Cryptocurrency.	8
IV	**Privacy And Security Techniques Used in Blockchain:** Hyperledger, Cryptography in Blockchain: Symmetric Cryptography, Asymmetric Cryptography, Cryptographic Hash, how security differs by blockchain types?, Keys in Cryptography.	8
V	**Blockchain Uses:** Financial Services, Medical and healthcare, Blockchain city, Education Services.	8

Text Books:
1. Mark Gates, "Blockchain-Ultimate Guide to Understand blockchain," Wise Fox Publishing.
2. Vikram Dhillon, David Metcalf, Max Hooper "**Blockchain Enabled Applications"** Apress.

Reference
1. Tiana Laurence,"Blockchain For Dummies,", John Wiley & Sons, Inc.

2. Melanie Swa, "Blockchain", O' Reilley.	
Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	15 - 10 - 75
Total:	**100**

Course Learning Outcomes:

CO1: Explain how a blockchain records and verifies transactions.
CO2: Contribute to the development of new blockchain protocols or standards.
CO3: Simulate cryptocurrency transactions on a test network.
CO4: Able to explain about Hyperledger used in Blockchain technology.
CO5: Compare and contrast different blockchain platforms and their suitability for specific applications.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Data Mining & Data Warehousing**
Course Code: 25BCS-CS304-2	**Title: Data Mining & Data Warehousing**

Course Objectives:
CO1: To Understand data warehousing components, architecture, and OLAP concepts.
CO2: To Comprehend data mining fundamentals, functionalities, and major issues.
CO3: To Explore classification, prediction, and association rule mining algorithms
CO4: To Learn various clustering methods including partitioning, hierarchical, and density-based approaches.
CO5: To Understand mining of complex data objects, spatial, multimedia, text, and web data.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Data Warehousing** Overview and Concepts: Data Warehousing Components, Building a Data Warehouse, Data Warehouse Architecture, Data Extraction, Cleanup, and Transformation Tools, Metadata, Reporting, Query tools and Applications, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.	8
II	**Data Mining** Introduction: Fundamentals of Data Mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Major issues in Data Mining. Data Pre-processing, Need for Pre-processing the Data, Data Cleaning, Data Integration & Transformation, Data Reduction, Decentralization and Concept Hierarchy Generation	8
III	**Data Mining Techniques** Classification and Prediction:- Issues Regarding Classification and Prediction, Classification by Decision Tree, Bayesian Classification, Rule Based Classification, Association Rule Mining, Efficient and Scalable Frequent Itemset Mining Methods, Market Basket Analysis, Apriori Algorithm, Tree Based Algorithms, Prediction – Regression Models, Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor	8
IV	**Cluster Analysis** Clustering Overview, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Partitioning Clustering-K-Means Algorithm; Basic Agglomerative Hierarchical Clustering Algorithm, Key	8

	Issues in Hierarchical Clustering, Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods- Neural Network Approach, Outlier Analysis.	
V	**Mining Object, Spatial, Multimedia, Text and Web Data:** Mining the World Wide Web, Multimedia Data Mining, Text Mining, Web Content Mining, Web Structure Mining, Web Usage Mining Data Analysis and Visualization: Correlation, Covariance, Rank and Percentile.	8

Text Books:

1. Jiawei Han, Jian Pei, Micheline Kamber, *"Data Mining: Concepts and Techniques"*, Elsevier.
2. Margaret H. Dunham, "*Data Mining: Introductory and Advanced Topics",* Pearson Education.
3. Arun K. Pujari, *"Data Mining Techniques"*, Universities Press
4. Pieter Adriaans&DolfZantinge, *"Data Mining"*, Pearson Education

Reference

1. "Introduction to Data Mining" by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar.
2. "*Data* Warehousing, Data Mining, and OLAP" by Alex Berson and Stephen Smith.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Student is able to design data warehouse schemas and apply OLAP techniques for data analysis.
CO2: Student is able to perform data pre-processing steps like cleaning, integration, and reduction
CO3: Student is able to apply decision trees, Bayesian classification, and Apriori algorithm to real-world problems
CO4: Student is able to implement K-Means, hierarchical clustering, and DBSCAN algorithms.
CO5: Student is able to analyze and visualize data using advanced charts and reporting tools.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester-; III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 2 **Theory: 2** **Practical: 0**	**Course: R-Programming**
Course Code: 25BCS-CS305	**Title: R-Programming**

Course Objectives:
CO1: To introduce participants to the R programming language and its environment
CO2: To equip learners with the skills to manipulate data, perform statistical analyses, and create visualizations using R.
CO3: To provide participants basics of function and programming loops.
CO4: To provide insights into advanced data analysis techniques, including machine learning algorithms within the R ecosystem.
CO5: To foster the ability to tackle real-world data problems and derive actionable insights using R.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 40% Marks / 2 Credits (Internal +ESE)

L: 2
T: 0
P: 0(In Hours/Week)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to R Programming**: Overview of R and its IDEs (RStudio), Basics of R syntax and programming concepts, Installing a R Package, Few commands to get started: installed.packages(), packageDescription(), help(), find.package(), library() - Input and Output – Entering Data from keyboard.	6
II	**R Data Types:** Vectors, Lists, Matrices, Arrays, Factors, Data Frame. **R - Variables:** Variable assignment, Data types of Variables, Finding Variable, Deleting Variables. **R Operators:** Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators.	6
III	**R Decision Making:** if statement, if – else statement, if – else if statement, switch statement. **R Loops:** while loop, for loop - Loop control statement: break statement, next statement. **R-Function:** function definition, calling a function **Built in functions:** mean(), paste(), sum(), min(), max(), seq(), user-defined function.	6
IV	**R-Strings** – Manipulating - R Vectors – Sequence vector, rep function, vector access, vector names, vector math, vector recycling, vector element sorting R List - Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, - R Matrices – Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division- R Arrays:, Accessing Array Elements, Manipulating Array Elements, - R Factors –creating factors.	6

	String functions : grep(), nchar() , paste(), sprintf(), substr(), strsplit(), regex() gregexpr(), toupper(), tolower(), paste() Solving problems from assignment sheet.	
V	Data Frames –Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions - Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() –Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir() - Writing into a CSV File – R -Excel File – Reading the Excel file.	6

Text Books:

1. "The Book of R" by Tilman M. Davies, no starch press(San Francisco)
2. "The Art of R programming" by Norman Matloff, no starch press(San Francisco)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Demonstrate proficiency in R programming basics, including data types, functions, and control structures.
CO2: Able to perform function and programming loops.
CO3: Able to create basic data frames and represent data.
CO4: Able to manipulate and read data automatically.
CO5: Develop and implement R scripts and functions to automate data analysis tasks, enhancing productivity and ensuring reproducibility.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: R-Programming Lab**
Course Code: 25BCS-CS305P	**Title: R-Programming Lab**

Course Objectives:
To learn the student should be made to:
CO1: Introduction to Basic R environment.
CO2: Implement R script to show the usage of various operators available in R language.
CO3: Implementation of basic building of logic and functions.
CO4: Implement R Script to create a list and access data from list.
CO5: Basics of scripting and performing various operations on vectors.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (ESE + Internal)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	R basics, Installation, Data types and Functions	2
II	Implement R script to show the usage of various operators available in R language.	2
III	Implement R script to perform various operations on vectors	2
IV	Implement R script to find biggest number between two numbers.	2
V	Implement R Script to create a list.	2
VI	Implement R Script to access elements in the list.	2
VII	Implement R Script to perform matrix operation.	2
VIII	Implement R script to read person‘s age from keyboard and display whether he is eligible for voting or not.	2

Reference / Text Books:
1. Fundamentals of Database System by Elmasari & Navathe, 7th Edition, 2018, Pearson Education.
2. Database System Concepts by Silberschatz, Korth & Sudarshan, 6th Edition, 2019, Mc Graw-Hill Education.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-

5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Design and implement basics of R Programming
CO2: Populate and implement basic operation and simple logic building
CO3: Create and maintain tables, list and vectors and access data.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Cyber Security**
Course Code: 25BCS-CS306	**Title: Cyber Security**
Course Objectives:	
CO1: Upon successful completion of this course, students will be able to: CO2: Understand the foundational concepts of cyberspace and the internet's architecture. CO3: Identify and analyze various forms of cybercrime and the legal frameworks designed to combat them. CO4: Recognize security threats associated with social media and apply best practices for safe online interaction. CO5: Comprehend the security aspects of e-commerce and digital payment systems, including common frauds and preventive measures. CO6: Implement essential security measures for digital devices and utilize basic cybersecurity tools and technologies.	
Nature of Paper: VAC	
Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)	
L: 3 T: 0 P: 0 (In Hours/Week) Theory-1Hr.=1Credit Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)	

Unit	Contents	No. of Lectures Allotted
I	Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	8
II	Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.	8
III	Social Media Overview and Security: Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media,	8

	Flagging and reporting of inappropriate content, Laws, regarding posting of inappropriate content, best practices for the use of social media, Case studies.	
IV	E–Commerce and Digital Payments: Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007,	8
V	Digital Devices Security, Tools, and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	8

Text Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (1st Edition, 2011)
2. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001)
3. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
5. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

Reference:

1. Fundamentals of Network Security by E. Maiwald, McGraw Hill..
2. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: After completion of this module, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2: Students, at the end of this module, should be able to understand the cyber-crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

CO4: After the completion of this module, students would be able to understand the basic concepts

related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.
CO5: Students, after completion of this module will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: OOPs Using Java**
Course Code: 25BCS-CS401	**Title: OOPs Using Java**

Course Objectives:
CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of abstraction.
CO4: Able to understand the use of Packages and Interface in java.
CO5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to OOPs and Java:** OOPs Concepts, Top-Down Approach and Bottom Up Approach, Introduction to Java, History of Java, Features of Java, Byte Code, JVM, JRE, JDK, JIT, Java Applications, Character Set, Identifiers, Literals, Comments, Keyword, Data Type, Operators, Conditional Statements, Looping Statements, Array Declaration, Creation, Initialization. **String Handling:** Predefined Functions in String, String Methods, Command-Line Arguments.	8
II	**Classes, Objects and Methods:** Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors, Types of Constructors, this, super & static keyword, Inheritance, Types of Inheritance, Method Over Loading & Overriding, final keyword, Abstract Class.	8
III	**Interfaces and Packages:** Defining Interfaces, Extending and Implementing Interfaces, Defining Packages, Access Protection, Importing Packages, **Exception Handling:** Exception Types, Multiple Catch Clauses, Nested Try Statements, Throw, Throws, Finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.	8
IV	**Multithreaded Programming:** Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority, Runnable interface. **Managing I/O Files:** Introduction, Streams, Stream Classes, File Class, Creation of Files, Reading and Writing to File.	8
V	**GUI Programming and Event Handling:** AWT, Swing, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like JButtons, JCheck Boxes, JRadio Buttons, JLabels, JText Fields, JText Areas, JCombo	8

	Boxes, Sliders, Windows, Menus, Dialog Box, Event handling in java, Event types, Mouse and key events. **Connecting to Database:** JDBC Type 1 to 4 drivers, Connecting to a database, querying a database and processing the results, updating data with JDBC.	

Text Books:

1. Patrick Naughton and Herbertz Schildt, "Java-2 The Complete Reference", McGraw Hill.
2. Ivor Horton, "Beginning Java-2", Wiley Publishing.
3. Balaguruswamy, "Programming with Java: A Primer", Tata McGraw Hill Education.

Reference:

1. Horetmann Cay and Cornell Gary, "Core Java Volume – I", Pearson Education.
2. Horetmann Cay and Cornell Gary, "Core JavaTM 2, Volume II – Advanced Features", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of abstraction.
CO4: Able to understand the use of Packages and Interface in java.
CO5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: OOPs using Java Lab**
Course Code: 25BCS-CS401P	**Title: OOPs using Java Lab**

Course Objectives:
CO1: Understand and apply the fundamental concepts of Object-Oriented Programming using Java.
CO2: Solve real-world problems using Java classes, objects, inheritance, and polymorphism.
CO3: Apply abstraction, interfaces, and packages to develop modular programs.
CO4: Implement robust Java applications using exception handling and multithreading.
CO5: Create GUI-based applications and perform file/database operations using Java I/O and JDBC.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction, Basic Syntax, and Control Structures:** 1. Write a Java program to display "Hello, World!" using command-line arguments. 2. Develop a Java program for simple arithmetic operations using control statements. 3. Implement a Java program to demonstrate usage of loops (for, while, do-while). 4. Write a Java program to check whether a string is a palindrome using String methods.	3
II	**Introduction, Basic Syntax, and Control Structures:** 1. Write a Java program to use ***static and super*** keyword. 2. Implement a Java program to demonstrate usage of **constructor.** 3. Implement a Java program to demonstrate usage of **abstract classes.** 4. Implement a Java program to demonstrate usage of **Inheritance**	3
III	**Interfaces, Packages, and Exception Handling:** 1. Write a program to create and use user-defined packages. 2. Develop an application using interfaces and multiple inheritance. 3. Create a program demonstrating try, catch, finally, throw, and throws. 4. Develop a custom exception class and use it in a program to handle user-defined exceptions.	3
IV	**Multithreading and File I/O:** 1. Write a program to create threads using Thread class and Runnable interface.	3

	2. Implement thread synchronization using synchronized methods. 3. Write a Java program to create and write to a file using File Output Stream. 4. Develop a program to read content from a file and display it using Buffered Reader.	
V	**GUI Programming and Database Connectivity:** 1. Create a simple GUI form using Swing components such as JButton, JLabel, JTextField, etc. 2. Write a Java program using Swing to build a calculator application. 3. Develop a program to connect to a MySQL database using JDBC and retrieve data. 4. Implement insert, update, delete operations in a database using JDBC.	3

Text Books /Reference:

1. Patrick Naughton and Herbertz Schildt, "Java-2: The Complete Reference", McGraw Hill.
2. E. Balaguruswamy, "Programming with Java: A Primer", Tata McGraw Hill Education.
3. Cay S. Horstmann & Gary Cornell, Core Java Volume I & II, Pearson Education.
4. Ivor Horton, *Beginning Java 2*, Wiley Publishing.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Develop and test Java programs using object-oriented features like classes, objects, and constructors.

CO2: Implement inheritance, method overloading/overriding, and abstraction.

CO3: Apply interfaces, packages, and exception handling mechanisms in Java programs.

CO4: Develop multithreaded applications and perform file I/O operations in Java.

CO5: Design GUI-based applications with AWT/Swing and integrate database operations using JDBC.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Software Engineering**
Course Code: 25BCS-CS402	**Title: Software Engineering**

Course Objectives:

CO1: Introduce and apply various software development process models, enabling students to select the most appropriate model based on project needs.
CO2: Develop the ability to gather, analyze, and document software requirements for different kinds of software systems using industry standards.
CO3: Impart foundational knowledge of software architecture and design principles.
CO4: Familiarize students with essential concepts in software project management, including cost estimation, scheduling, and progress tracking.
CO5: Equip students with practical knowledge of software testing and debugging techniques, and the ability to assess their effectiveness in real-world scenarios.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction: Software- Characteristics and Applications, Software Engineering, Software Engineering Layers, Software Process Framework, CMM, Software Quality Attribute and Metrics, Software Development Life Cycle, Software Process ModelsWater Fall Model, Prototyping Model, RAD Model, Spiral Model, Evolutionary Models, Component-based Development Model.	8
II	Software Requirements Engineering and Analysis Modeling: Software Requirements, Requirement Engineering Process, Elicitation Requirements, Analysis and Negotiating Requirements, Requirement Specification, System Modeling, Requirements Validation, Requirement Management, Creating a Software Requirements Specification Document, IEEE Standards for SRS, Feasibility Study, Elements of Analysis Model, Data Modeling- ER Diagram, Information Modeling- DFD, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.	8
III	Software Design and Implementation: Design Process, Principles, and Design Concepts-Abstraction, Architecture, Refinement, Modularity, Data Structure, Information Hiding, Functional Independence, Cohesion, Coupling; Design Documentation, Design Strategies-Top Down and Bottom Up Design; Design ModelData Design Elements, Architectural Design, User Interface Design, Component-Level Design, Deployment-Level Design, Implementation Issues	8

	and Programming Support Environment.	
IV	Software Testing: Verification, Validation, Testing Objectives, Unit Testing, Integration Testing, Validation Testing, System Testing, Acceptance Testing, Regression Testing, Test Characteristics, White Box Testing, Basic Path Testing, Control Structure Testing, Black Box Testing, Test Plan, Test Case Design, Quality Metrics for Testing.	8
V	Software Maintenance: Nature and Need of Maintenance, Types of Maintenance (Perceptive, Preventive, Adoptive, Corrective), Cost of Maintenance, Evolution of Software, Software Maintenance Process, Software Maintenance Techniques-Reverse Engineering, Reengineering; Factors affecting Software Maintenance, Key Issues in Maintenance, Software Configuration Management, Version and Release Control, Change Control.	8

Text Books:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", Addison Wesley.
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer.

Reference:

1. K. K. Aggarwal & Yogesh Singh "Software Engineering", New Age International.
2. I. Sommerville, "Software Engineering", Pearson Education.
3. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
4. Subramanian Chandramouli, Saikat Dutt, Chandramouli Seetharaman, B. G Geetha, "Software Engineering", Pearson Education India

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Differentiate between various software process models and justify their use in real-life software projects.
CO2: Construct data flow diagrams (DFDs), entity-relationship diagrams (ERDs), and other models to represent software requirements effectively.
CO3: Create design models including architectural, data, and user interface designs for software systems.
CO4: Design effective test plans and test cases and evaluate testing outcomes using quality metrics.
CO5: Apply maintenance techniques such as reverse engineering and reengineering in evolving software systems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Software Engineering Lab**
Course Code: 25BCS-CS402P	**Title: Software Engineering Lab**

Course Objectives:
CO1: Solve different types of case diagram.
CO2: Apply white box and black box testing.
CO3: Solve state diagram and activity diagram.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Draw the use case diagram and specify the role of each of the actors. Also state the precondition, post condition and function of each use case	2
II	Preparation of Software Requirement Specification Document and Design Documents.	2
III	Identify the classes. Classify them as weak and strong classes and draw the class diagram.	2
IV	Preparation of Software Configuration Management and Risk Management related documents	2
V	Study and usage of any Design phase CASE tool.	2
VI	Prepare a SRS document in line with the IEEE recommended standards.	2
VII	Develop test cases for unit testing and integration testing.	2
VIII	Develop test cases for various white box and black box testing techniques.	2
IX	Draw the activity diagram	2
X	Draw the state chart diagram.	

Text Books:
- RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
- Pankaj Jalote, Software Engineering, Wiley

Reference Books
- Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
- K.K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Able to solve different types of case diagram.
CO2: Able to apply white box and black box testing on SRS.
CO3: Evaluate state diagram and activity diagram.

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IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Computer Graphics**
Course Code: 25BCS-CS403	**Title: Computer Graphics**

Course Objectives:
CO1: Solve different types of display techniques.
CO2: Apply Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Solve 2DTransformations and Composition of 3-D Transformation.
CO4: Apply Point, Text, Line, Polygon Clipping and Cohen-SutherlandClipping Algorithm
CO5: Solve Pipeline and Different Types of Projections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic of Computer Graphics, Uses of Computer Graphics, Shadow mask techniques, CRT working, Visual Display Devices-Refresh CRT, Raster-Scan Displays, Random-Scan Displays, Color-CRT Monitors, DVST, Flat Panel Displays, 3-D Viewing Devices, Stereoscopic and Virtual-Reality Systems; Raster-Scan System, Random Scan System, Input/Output Devices, Hard-Copy Devices, Color Models: RGB, CMY, HSV, HLS Color Models.	8
II	**Output Primitives Algorithms:** Scan Conversion: Point, Line, Circle, Ellipse, Polygon; Filled area Algorithms: Scan-line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood-Fill Algorithm, Aliasing, and Introduction to Anti-Aliasing.	8
III	**Geometric Transformations:** 2-Dimensional Transformations (Translation, Rotation, Scaling, Reflection, Shear, Inverse Transformation, Composite Transformation, Homogeneous Coordinates and Matrix Representation, Matrix Representation of 3-D Transformations, Composition of 3-D Transformation.	8
IV	**Two-Dimensional Viewing and Clipping:** Viewing Pipeline, The Window-to-View port Transformations, Convex and Concave Clipping, Point Clipping, Line Clipping-Cohen-Sutherland Polygon Clipping, Liang-Bar sky Line Clipping, Cyrus-Beck Algorithm, Midpoint Sub division Algorithm; Sutherland-Hodgeman Polygon clipping.	8
V	**Three-Dimensional Viewing and Clipping:** Viewing Pipeline, Projections, Types of Projections, The Mathematics of Planner Geometric Projections, Parametric Representation of Curves: Bezier Curves, B-Spline Curves, Z-	8

	Buffer algorithm, Scan Line Algorithm, Area subdivision algorithm	

Reference:

1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press.
2. John Vince, "*Mathematics for Computer Graphics",* Springer.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Learned and solved different types of display techniques.
CO2: Learned and Solved concepts of Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Learned and Solved 2DTransformations and Composition of 3-D Transformation.
CO4: Applied Point, Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm
CO5: Learned and Solved Pipeline and Different Types of Projections techniques.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Computer Graphics Lab**
Course Code: 25BCS-CS403P	**Title: Computer Graphics Lab**

Course Objectives:
CO1: Solve different types of display techniques.
CO2: Apply Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Solve 2DTransformations and Composition of 3-D Transformation.
CO4: Apply Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm
CO5: Solve Pipeline and Different Types of Projections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit (4Hrs./Week=2 Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a Program to draw basic graphics construction like line and Hut.	2
II	Write a Program to draw basic graphics construction like circle and transistor.	2
III	Write a Program to draw basic graphics construction like arc and moving images.	2
IV	Write a Program to draw basic graphics construction like ellipse and different shapes.	2
V	Write a Program to draw basic graphics construction like rectangle and smile face	2

Text Books:
1. D. Hearn & M.P. Baker, "*Computer Graphics*", Pearson Education.
2. Foley, VanDam, Feiner, Hughes, "*Computer Graphics: Principles & Practice*", Addison Wesley Professional.

Reference:
1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press.
2. John Vince, "*Mathematics for Computer Graphics",* Springer.

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Prerequisites for the course: NIL
Course Learning Outcomes: CO1: Learned and Solved different types of display techniques.. CO2: Learned and Solved concepts of Point, Line, Circle, Ellipse, Polygon algorithm. CO3: Learned and Solved 2DTransformations and Composition of 3-D Transformation. CO4: Applied Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm CO5: Learned and Solved Pipeline and Different Types of Projections techniques.

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IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: IOT**
Course Code: 25BCS-CS404-1	**Title: IOT**

Course Objectives:

CO1: To analyze the conceptual framework, architectural components, and technological foundations of IoT and M2M communication systems, enabling students to evaluate their applications and design principles for connected devices.

CO2: Analyze and evaluate various hardware components and embedded platforms used in IoT systems, including sensors, actuators, RFID technology, and wireless sensor networks, to understand their roles and applications in real-world IoT environments.

CO3: Evaluate various wireless medium access and routing protocols used in IoT networks, and analyze strategies for sensor deployment, node discovery, and efficient data aggregation to optimize network performance.

CO4: Enable students to apply foundational programming concepts to configure and operate Arduino boards for real-world IoT applications using the Arduino IDE and relevant libraries.

CO5: Help students understand the key design, development, and security challenges in IoT systems, along with the diverse applications ranging from smart metering to smart city infrastructure.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (3Hrs./Week=3Credits)

Unit	Contents	No. of Lectures Allotted
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	8
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Net Arduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	8
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.	8
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy,	8

	Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	8

Text Books:

1. Olivier Hersent, David Boswar thick, Omar Elloumi "The Internet of Things key applications and protocols", willey.
2. Jeeva Jose, Internet of Things, Khanna Publishing House.
3. Michael Miller "The Internet of Things" by Pearson.
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016.
5. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications, 2014.
6. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India.

Reference:

1. "Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti at Universities Press (2014)
2. "Internet of Things: Principles and Paradigms" by Rajkumar Buyya, Amir Vahid Dastjerdi *Publisher:* Morgan Kaufmann
3. "Building Internet of Things with the Arduino" by Charalampos Doukas *Publisher:* Packt Publishing
4. "Internet of Things: Architecture and Design Principles" by Rajkumar Buyya, Satish Narayana Srirama *Publisher:* Wiley (2020)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: By the end of the course, students will be able to design IoT/M2M systems by applying standardized communication technologies and data enrichment strategies to create affordable and efficient

CO2: By the end of the course, students will be able to design and implement basic IoT solutions using embedded platforms such as Arduino and Raspberry Pi, integrating sensors, actuators, and wireless communication modules to solve practical problems.

CO3: Students will be able to compare and select appropriate MAC and routing protocols for specific IoT scenarios, and implement node deployment and data dissemination techniques to enhance communication efficiency within sensor networks.

CO4: By the end of this course, learners will be able to analyze and troubleshoot Arduino-based IoT systems by interpreting code behavior through emulators and physical board testing.

CO5: By the end of the course, students will be able to evaluate IoT application designs—such as smart street lighting or home automation—by identifying potential technical and security challenges and proposing viable solutions.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mobile Application Development**
Course Code: 25BCS-CS404-2	**Title: Mobile Application Development**

Course Objectives:
CO1: Understand the fundamentals of Android operating system, its architecture, and development tools.
CO2: Learn the design and lifecycle of Android activities, intents, and fragments for building multi-screen applications.
CO3: Develop intuitive and interactive user interfaces using various Android views and layouts.
CO4: Implement data storage and management using SQLite database in Android applications.
CO5: Explore background services, messaging features, and the complete process of publishing Android applications.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Android:** Overview, History, Features of Android, Architecture of Android. Android Phones, SDK. Android Development Tools. Android Emulator. Creating Android Virtual Device. Creating your first Android Application.	8
II	**Activities:** Introduction, Activity Lifecycle. **Intents:** Introduction. Linking Activities using Intents. Calling built-in applications using Intents, **Fragments:** Introduction. Adding Fragments Dynamically. Lifecycle of Fragment. Interaction between fragments.	8
III	**Android User Interface:** Understanding the components of a screen. Display Orientation. **Designing Your User Interface with Views:** Basic Views. Picker Views List View Specialized Fragment, Displaying Pictures and Menes with views.	8
IV	**Databases - SQLite:** Introduction, Creating. Opening and Closing Database Working with Cursors, Insert, Update, Delete, Building and Executing Queries.	8
V	**Messaging and E-mail:** SMS Messaging and Send Email. **Developing Android Services**: Creating Services Communication between a Service and an Activity, Binding Activities to Services. **Publishing Android Application**: Preparing for abusing. Deploying APK	8

	Files	

Text Books:

- Lauren Darcey & Shane Conder, Android Wireless Application Development, Pearson Education, 3rd Edition.
- Barry Burd, Android Application Development All-in-One for Dummies, Wiley India, Latest Edition.

Reference

- Reto Meier & Ian Lake, Professional Android, Wrox Press, 4th Edition.
- Joseph Annuzzi Jr., Lauren Darcey, Shane Conder, Advanced Android Application Development, Addison-Wesley, 4th Edition.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar/Attendance	-
3) Assignments/TA	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcome

CO1: Describe the history, features, and architecture of Android and set up the Android development environment.
CO2: Apply activity lifecycle concepts and use intents and fragments to manage multi-screen app navigation.
CO3: Design and develop user-friendly Android applications using appropriate UI components.
CO4: Perform CRUD (Create, Read, Update, Delete) operations using SQLite in Android.
CO5: Integrate services and messaging features and prepare Android applications for deployment on the Google Play Store.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: BSc(CS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Professional Skills**
Course Code: 25BCS-CS406	**Title: Professional Skills**

Course Objectives:

CO1: Develop professional skills by understanding personal growth, workplace behavior, and continuous professional development.
CO2: Identify and strengthen professional talents through self-assessment, communication, teamwork, and leadership skills.
CO3: Apply goal-setting techniques and career planning strategies to achieve personal and professional objectives.
CO4: Gain practical workplace exposure by participating in internships and demonstrating professional responsibility.
CO5: Demonstrate ethical behavior, inclusivity, customer orientation, and collaboration to enhance employability skills.

Nature of Paper: AECC-4

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Professional Development: Meaning of professional development, importance of professional skills, types of professional development, lifelong learning, personal branding, work–life balance.	8
II	Identifying Professional Talents: Professional talents and skills, soft skills and hard skills, self-assessment, communication skills, teamwork, leadership, time management, emotional intelligence.	8
III	Goal Setting and Career Planning: Meaning of goals, SMART goals, steps of goal setting, career planning, self-assessment, career options, skill development, professional networking.	8
IV	Internship and Workplace Exposure: Meaning of internship, objectives of internship, types of internships, benefits of internships, employer and intern responsibilities, internship preparation.	8
V	Workplace Ethics and Employability Skills: Professional ethics, equality and equity, gender sensitivity, cultural diversity, customer service, collaboration, administrative skills, marketing and networking skills.	8

Text Books:

1. Covey, Stephen R. *The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change*. Free Press, 1989.
2. Locke, Edwin A., and Gary P. Latham. *A Theory of Goal Setting and Task Performance.* Prentice Hall, 1990.
3. Oldman, Mark, and Samer Hamadeh. *The Internship Bible*. Princeton Review Publishing, 2005.
4. Sharma, Prshant.. *Soft Skills Personality Development for Life Success*. BPB Publications 20, Ansari Road, Darya Ganj, New Delhi-110002, 2019.
5. Subramanian, R. *Professional ethics* (2nd ed.). Oxford University Press India, 2014.

Reference

1. Robbins, Stephen P., and Timothy A. Judge. *Organizational Behavior*. Pearson Education, 2017.
2. Greenhaus, Jeffrey H., Gerard A. Callanan, and Veronica M. Godshalk. *Career Management*. SAGE Publications, 2019.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Classtasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: **On completion of this module, students will be able to** understand professional development, lifelong learning, and work–life balance.

CO2: **By the end of this module, students will learn to** identify their talents and build essential soft and hard skills.

CO3: **After successful completion, students will be able to** set SMART goals and plan their careers effectively.

CO4: **At the conclusion of this module, students will be able to** understand internships and prepare for workplace exposure.

CO5: **Upon completing this module, students will be able to** apply workplace ethics and key employability skills.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Computer Graphics**
Course Code: BCS-NEP-501	**Title: Computer Graphics**

Course Objectives:
CO1: Solve different types of display techniques.
CO2: Apply Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Solve 2DTransformations and Composition of 3-D Transformation.
CO4: Apply Point, Text, Line, Polygon Clipping and Cohen-SutherlandClipping Algorithm
CO5: Solve Pipeline and Different Types of Projections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic of Computer Graphics, Uses of Computer Graphics, Shadow mask techniques, CRT working, Visual Display Devices-Refresh CRT, Raster-Scan Displays, Random-Scan Displays, Color-CRT Monitors, DVST, Flat Panel Displays, 3-D Viewing Devices, Stereoscopic and Virtual-Reality Systems; Raster-Scan System, Random Scan System, Input/ Output Devices, Hard-Copy Devices, Color Models: RGB, CMY, HSV, HLS Color Models.	8
II	**Output Primitives Algorithms:** Scan Conversion: Point, Line, Circle, Ellipse, Polygon; Filled area Algorithms: Scan-line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood-Fill Algorithm, Aliasing, and Introduction to Anti-Aliasing.	8
III	**Geometric Transformations:** 2-Dimensional Transformations (Translation, Rotation, Scaling, Reflection, Shear, Inverse Transformation, Composite Transformation, Homogeneous Coordinates and Matrix Representation, Matrix Representation of 3-D Transformations, Composition of 3-D Transformation.	8
IV	**Two-Dimensional Viewing and Clipping:** Viewing Pipeline, The Window-to-View port Transformations, Convex and Concave Clipping, Point Clipping, Line Clipping-Cohen-Sutherland Polygon Clipping, Liang-Bar sky Line Clipping, Cyrus-Beck Algorithm, Midpoint Sub division Algorithm; Sutherland-Hodgeman Polygon clipping.	8
V	**Three-Dimensional Viewing and Clipping:** Viewing Pipeline, Projections, Types of Projections, The Mathematics of Planner Geometric Projections, Parametric Representation of Curves: Bezier Curves, B-Spline Curves, Z-	8

	Buffer algorithm, Scan Line Algorithm, Area subdivision algorithm	

Reference:

1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press.
2. John Vince, "*Mathematics for Computer Graphics",* Springer.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Learned and Solved different types of display techniques.
CO2: WAP for Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Learned and Solved 2DTransformations and Composition of 3-D Transformation.
CO4: Applied Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm.
CO5: Learned and Solved Pipeline and Different Types of Projections techniques.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Python Programming**
Course Code: BCS-NEP-502	**Title: Python programming**

Course Objectives:
CO1: Understand and use variables.
CO2: Work with common Python data types, like integers, floats, strings as well as pandas Data frames.
CO3: Use basic flow control including for loops and conditionals.
CO4: Read data from text files.
CO5: Obtain basic summary statistics from data files.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Installing Python in Windows/Linux/Mac OS, Using Python interpreter, Execute a Script, Structuring with Indentation, Editors. **Data types and Variables:** Variables, Variables v/s identifiers, Naming convention of variables, Keywords. **Data Structure:** List, Tuples, Sets, Dictionaries	8
II	**Input And Output:** Input function, Input with raw input(),Output with old string format, Python format function **Control Flow:** If/Else Statements, For/while Statements, Range() function, Break and continue statements, Else clauses on Loops.	8
III	**Functions**: Defining Function, Default Argument, Keyword Argument, Arbitrary Arguments List. **File Handling**: Reading from the file, Writing to the file, Methods of file objects. **Error And Expectation:** Syntax Errors, Exceptions, Handling Exceptions (try, except).	8
IV	**Module**: Creating Modules, import a module, Import the names, Executing modules as scripts. **Class Concept:** Class Syntax, Class Objects, Instance Objects, Method Objects, Class and Instance Variables.	8

V	**Advanced Modules:** Regular Expressions, date time - date and time libraries, Dealing with Excel, GUI, Web Scrapping. **Advanced Modules**: Regular Expressionsϖ date time - date and time libraries. Dealing with Excelϖ GUIϖ Web Scrappingϖ	8

Text Books:

1. Python Cook book Author: By David Beazley and Brian K. Jones
2. **The Python Book: The Ultimate Guide to Coding with Python by Aaron Asadi (ed.)**

Reference:

1. Python-(Mark Lutz)
2. Python Training guide (BPB Publications)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations/Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Data Mining

Course Learning Outcomes:

CO1: The course is designed to provide Basic knowledge of Python.
CO2: Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
CO3: Express proficiency in the handling of strings and functions.
CO4: Identify the commonly used operations involving file systems and regular expressions.
CO5: Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: ERP**
Course Code: BCS-NEP-503	**Title: ERP**

Course Objectives:

CO1: To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
CO2: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO3: To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
CO4: To develop a process driven thinking towards business processes.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to ERP:** Evolution of ERP;. what is ERP?, Reasons for the Growth of ERP; Scenario and Justification of ERP in India;. Evaluation of ERP; Various Modules of ERP; Advantage of ERP.	8
II	**An Overview of Enterprise:** An Overview of Enterprise;. Integrated Management Information;. Business Modelling;. ERP for Small Business;. ERP for Make to Order Companies;. Business Process Mapping for ERP Module Design;. Hardware Environment and its Selection for ERP Implementation	8
III	**ERP and Related Technologies:** ERP and Related Technologies;. Business Process Reengineering (BPR);. Management Information System (MIS);. Executive Information System (EIS);. Decision support System (DSS);. Supply Chain Management (SCM).	8
IV	**ERP Market:** Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Co, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.	8
V	**ERP Implementation Lifecycle:** Issues in Implementing ERP Packages;. Pre-evaluation Screening;. Package Evaluation;. Project Planning Phase; Gap Analysis; Reengineering; Configuration; Implementation; Team Training;	8

	Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).	

Text Books:

1. Daniel E.O' Leary, Enterprise Resource Planning Systems, Cambridge University Press, 2002.
2. Ellen Monk, Bret Wagner, Concepts in Enterprise resource planning, Cengage learning, Third edition, 2009.

Reference

1. Enterprise Resource Planning – Alexis Leon – Second Edition – TMH
2. Manufacturing Resource Planning (MRP II) with Introduction to ERP; SCM; an CRM by Khalid Sheikh, Publisher: Mc. Graw-Hill

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Make basic use of Enterprise software, and its role in integrating business functions.
CO2: Analyze the strategic options for ERP identification and adoption.
CO3: Design the ERP implementation strategies.
CO4: Analyse the strategic options for ERP identification and adoption.
CO5: Create reengineered business processes for successful ERP implementation.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Big Data**
Course Code: BCS-NEP-503	**Title: Big Data**

Course Objectives:

CO1: Demonstrate knowledge of Big Data Analytics concepts and its applications in business.
CO2: Demonstrate functions and components of Map Reduce Framework and HDFS.
CO3: Develop queries in NoSQL environment
CO4: Explain process of developing Map Reduce based distributed processing applications.
CO5: Explain process of developing applications using HBASE, Pig etc.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	8
II	**Map-Reduce:** Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce.	8
III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop.	8

IV	**Hadoop Eco System and YARN:** Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. **NoSQL** Databases: Introduction to No SQL Mongo DB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections	8
V	**Hadoop Eco System Frameworks**: Applications on Big Data using Pig, Hive and HBase. **Pig**: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, **HBase** – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigI nsights and Big Sheets, introduction to Big SQL.	8

Text Book:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
2. Big-Data Black Book, DT Editorial Services, Wiley.

Reference Book:

1. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons
2. Pete Warden, “Big Data Glossary”, O’Reilly

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations/Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the concept of HDFS and map reduce.
CO1: Able to gather large data from a range of data sources.
CO3: Able to understand the hadoop ecosystem components
CO4: Able to explain the architecture of pig and hive with different operations.
CO5: Able to understand the importance and challenges of big data.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Data communication network**
Course Code: BCS-NEP-503	**Title: Data communication network**

Course Objectives:
CO1: To introduce the various types of computer networks.
CO2: To explore the various layers of OSI Model.
CO3: To introduce UDP and TCP Models.
CO4: To identify various application layer protocols.
CO5: To demonstrate the TCP/IP and OSI models

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks	8
II	Data link layer: Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, HDLC, Point to Point Protocols. ALOHA, CSMA/CD, LAN – Ethernet IEEE 802.3, IEEE 802.5 – IEEE 802.11, Random access, Controlled access, Channelization.	8
III	Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services,	8
IV	Network layer: Logical Addressing, Internetworking, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.	8
V	Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.	8

Text Books:
1. Data Communications and Networking, Behrouz A. Farozan, Fourth Edition TMH, 2006.
2. 2. Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.

Reference:
1. Data communications and Computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.
3. Computer Networking: A Top-Down Approach Featuring the Internet. James Kurose& Keith W. Ross, 3 rd Edition, Pearson Education.

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1. Students should understand and explore the basics of Computer Networks and Various Protocols. CO2. Students will be able to administrate a network and flow of information. CO3. Able to understand the World Wide Web Concepts. CO4. Able to understand the concepts of network security CO5. Able to secure device from network issues.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)**	**Year: III** **Semester: V**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Computer Graphics Lab**
Course Code: BCS-NEP-504P	**Title: Computer Graphics Lab**

Course Objectives:
CO 1: Solve different types of display techniques.
CO 2: Apply Point, Line, Circle, Ellipse, Polygon algorithm.
CO 3: Solve 2DTransformations and Composition of 3-D Transformation.
CO 4: Apply Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm
CO 5: Solve Pipeline and Different Types of Projections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal +ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Practical- 2 Hrs.=1Credit (4Hrs./Week=2 Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a Program to draw basic graphics construction like line and Hut.	2
II	Write a Program to draw basic graphics construction like circle and transistor.	2
III	Write a Program to draw basic graphics construction like arc and moving images.	2
IV	Write a Program to draw basic graphics construction like ellipse and different shapes.	2
V	Write a Program to draw basic graphics construction like rectangle and smile face	2

Text Books:
1. D. Hearn & M.P. Baker, "*Computer Graphics*", Pearson Education.
2. Foley, Van Dam, Feiner, Hughes, "*Computer Graphics: Principles & Practice*", Addison Wesley Professional.

Reference:
1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press.
2. John Vince, "*Mathematics for Computer Graphics",* Springer.

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Prerequisites for the course: NIL
Course Learning Outcomes: CO1: Learned and Solved different types of display techniques.. CO2: WAP for Point, Line, Circle, Ellipse, Polygon algorithm. CO3: Learned and Solved 2DTransformations and Composition of 3-D Transformation. CO4: Applied Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm CO5: Learned and Solved Pipeline and Different Types of Projections techniques.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)**	**Year: III** **Semester: V**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Python Programming Lab**
Course Code: BCS-NEP-505P	**Title: Python Programming Lab**

Course Objectives:
CO1: To be able to introduce core programming basics and various Operators of Python programming Language.
CO2: To demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries.
CO3: To understand about Functions, Modules and Regular Expressions in Python programming.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal + ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Sr.	Contents	No. of Lectures Allotted
I	Write a python script to check whether a given number is even or odd.	1
II	Write a Python script to add two integers' values taken from user.	1
III	Write a python script to calculate area of circle where radius is taken from user.	1
IV	Write a program to copy the content of one file to another file.	1
V	Write a Python Program to find the sum of series: 1 + 1/2 + 1/3.	1
VI	Write a program to find the sum of n natural numbers.	1
VII	Write a program to find factorial of a given number.	1
VIII	Write a program to find whether a given number is Armstrong number or not.	1
IX	Write a program takes a number and computes the prime factors of the integer.	1
X	Program to check whether a given number is a palindrome.	1

Text Books:
1. Pooja Sharma, "Programming in Python", BPB Publications.
2. Mark Summer field, "Programming in Python A Complete Introduction to the Python Language", Pearson Education.

Reference:
1. Mark Lutz, "Programming Python", O' Reilly Media.
2. Wesley J Chun,"Core Python Programming", Prentice Hall.
3. Alex Martelli, "Pythonina Nutshell", O' Reilly Media.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-

4) Research Project Report 5) ESE	- 25
Total:	**50**

Course Learning Outcomes:

CO1: Student should be able to understand the basic concepts of scripting and the contributions of scripting language.

CO2: Ability to explore python data structures like Lists, Tuples, Sets and dictionaries.

CO3: Ability to create practical and contemporary applications using Functions, Modules and Regular Expressions.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Cyber Security**
Course Code: BCS-NEP-601	**Title: Cyber Security**

Course Objectives:

CO1: Understand the various tools and methods used in cybercrime.
CO2: Identify risk management processes, risk treatment methods, organization of information security.
CO3: Classify cyber security solutions and information assurance.
CO4: Examine software vulnerabilities and security solutions to reduce the risk of exploitation.
CO5: Analyze the cyber security needs of an organization.

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Ethical Hacking:** Key issues plaguing the information security world, incident management process, and penetration testing, **Foot printing and Reconnaissance:** Various types of footprints, footprints tools, and countermeasures.	10
II	**Scanning Network:** Network scanning techniques and scanning countermeasure.	10
III	**Enumeration & Vulnerability Analysis:** Enumeration techniques and enumeration countermeasure. Vulnerability Analysis using different tools.	10
IV	**System Hacking & Malware Threats:** System Hacking Methodology, Steganography, Steg analysis attacks and covering tracks. Different types of Trojan, Trojan analysis and Trojan countermeasures, working of viruses, Virus analysis, computer worms, malware analysis procedure and communication.	10
V	**Sniffing & Social Engineering:** Packet sniffing techniques , identify theft , and social engineering countermeasure	10

Text Books:

1. K. Kumar," Cyber Laws: Intellectual property & E Commerce, Security", 1st Edition, Dominant Publisher, 2011.
2. Rodney D. Ryder, " Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.
3. Information Security policy &implementation Issues, NIIT, PHI.

Reference:

1. Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2nd Edition, PHI, 2003.
2. Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, 1st Edition, New Delhi, 2003.

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report 5) Seminar On Research Project Report 6) ESE	15 - - 10 75
Total:	**100**

Prerequisites for the course: Data Mining

Course Learning Outcomes:

CO1: Able to analyze and evaluate the cyber security needs of an organization.
CO2: Able to determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
CO3: Able to measure the performance and troubleshoot cyber security systems.
CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
CO5: Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Artificial Intelligence**
Course Code: BCS-NEP-602	**Title: Artificial Intelligence**

Course Objectives:
CO1: To understand about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: To study the concepts Propositional logics, predicate Logic.
CO3: To understand the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts.
CO4: To understand concepts of Prolog and Implement the Prolog Program.
CO5: To learning concepts of Expert system and Learning.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).	**9**
II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, No deductive Inference Methods, Rules.	**9**
III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts	**9**
IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/output and Streams, Databases, Implementation of All Concepts in Prolog.	**9**
V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition, Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Example-Induction, Explanation Based learning.	**9**

Text Books:

1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. Dan W. Patterson,*"Introduction to Artificial Intelligence& Expert Systems"*, PHI.
2. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.

Referential Books:

1. Stuart J. Russell & Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall.
2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Artificial Intelligence

Course Learning Outcomes:

CO1: Learn about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: Learn study the concepts Propositional logics, predicate Logic.
CO3: Learn the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts.
CO4: Learn concepts of Prolog and Implement the Prolog Program
CO5: Learn concepts of Expert system and Learning.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mobile Computing**
Course Code: BCS-NEP-603	**Title: Mobile Computing**

Course Objectives:
CO1: To understand the basic concepts of mobile computing.
CO2: To learn the basics of mobile data management system.
CO3: To be familiar with the network layer protocols and Ad-Hoc networks.
CO4: To know the basis of transaction and application layer protocols.
CO5: To gain knowledge about different mobile platforms and application development.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Mobile Computing:** Issues in Mobile Computing, Wireless Telephony, Digital Cellular Standards, Bluetooth Technology, Wireless Multiple Access Protocols, Channel Allocation in Cellular Systems. Wireless Application Protocol, WRITE A PROGRAM technology, Mobile Information device, Mobile Computing Applications.	8
II	**Data Management Issues:** Mobility, Wireless Communication and Portability, Data Replication and Replication Schemes, Basic Concept of Multihopping, Adaptive Clustering for Mobile Network, Multicluster Architecture.	8
III	**Location Management:** Location Based Services, Automatically Locating Mobile Uses, Locating and Organizing Services, Issues and Future Directions, Mobile IP, Comparison of TCP and Wireless.	8
IV	**Transaction Management:** Data Dissemination, Cache Consistency, Mobile Transaction Processing, Mobile Database Research Directions, Security Fault Tolerance for Mobile N/W.	8
V	What is Ad-hoc Network? , Problems with Message Routing in Wireless Ad-hoc Mobile Networks, Routing scheme based on signal strength, Link state and Distance Vector routing protocols, Ad-hoc on Demand Distance Vector .	8

Text Books:

1. Shambhu Upadhyaya, Abhijeet Chaudhary, Kevin Kwiat, Mark Weises, “Mobile Computing”, Kluwer Academic Publishers.
2. UWE Hansmann, Lothar Merk, Martin-S-Nickious, Thomas Stohe, “Principles of Mobile Computing”, Springer International Edition.
3. Wireless and Mobile Networks Architectures, by Yi-Bing Lin & Imrich Chlamtac, John Wiley &

Sons, 2001.	
Reference 1. Mobile and Personal Communication systems and services, by Raj Pandya, Prentice Hall of India, 2001. 2. Wireless Web Development, Ray Rischpater, Springer Publishing, 2000.	
Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	15 - - 10 75
Total:	**100**
Prerequisites for the course: Problem Solving using C	
Course Learning Outcomes: CO1: Understand about mobile communication with their different routing algorithms. CO2: Apply different data backup schemes used in mobile network to store the data. CO3: Able to explain about location management that is much important for mobile network. CO4: Build the knowledge of how transactions are done through mobile, different security issues while mobile transaction. CO5: Appraise different routing protocols used for routing the path like ADDV, DSR, FSR etc.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course : E-Commerce**
Course Code: BCS-NEP-603	**Title: E-Commerce**

Course Objectives:
CO1: Impart the students with knowledge and understanding of contemporary trendsin e-commerce.
CO2: Explain electronic system and Internet.
CO3: Describe the use of e-commerce security.
CO4: To provide adequate knowledge and understanding about E-Com practices to the students.
CO5: Understand the usage of planning and marketing for e-commerce.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L:4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**An introduction to Electronic commerce**: What is E-Commerce (Introduction and Definition), Main activities E-Commerce. Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, Electronic Commerce and Electronic Business(C2C)(C2G;G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C)	8
II	**The Internet and WWW:** Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.) , Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Barter, Exchange, Shopping Bots	8
III	**Internet Security:** Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime (Laws, Types of Crimes), Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus(How it spreads, Virus problem, virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authorization and Authentication, Firewall, Digital Signature.	8
IV	**Electronic Data Exchange:** Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash	8

V	**Planning for Electronic Commerce:** Planning Electronic Commerce initiates, Linking objectives to business strategies, Measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites. **Internet Marketing;** The PROS and CONS of online shopping, The cons of online shopping. Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.	8

Text Books:

1. G.S.V. Murthy, E-Commerce Concepts, Models, Strategies- :- Himalaya Publishing House, 2011.
2. Kamlesh K Bajaj and Debjani Nag, E- Commerce, 2005.

Reference

1. Gray P. Schneider, Electronic commerce, International Student Edition, 2011.
2. E-Commerce, Fundamentals and Applications, Wiely Student Edition,

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Identify and explain fundamental web site tools including design tools, programming tools, and data processing tools.
CO2: Apply the solutions on finding major electronic payment issues and options.
CO3: Acquire the knowledge of security issues and explain procedures used to protect against security threats.
CO4: Communicate effectively in ways appropriate to the discipline, audience and purpose.
CO5: Implement the corrective measures to management issues underlying e-Commerce issues including organizational structure, strategic planning, goal setting.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Real Time System**
Course Code: BCS-NEP-603	**Title: Real Time System**

Course Objectives:
CO1: To study the basic of tasks and scheduling.
CO2: To understand programming languages and databases.
CO3: To analyze real time communication.
CO4: To analyze evaluation techniques and reliability models for Hardware Redundancy.
CO5: To understand clock synchronization.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**INTRODUCTION TO TASK SCHEDULING:** Introduction - Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real time Systems, Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms, RM algorithm with different cases.	8
II	**UNI AND MULTI PROCESSOR SCHEDULING :** Uniprocessor scheduling of IRIS tasks, Task assignment, Utilization balancing – Next fit- Bin packing- Myopic off-line - Focused addressing and bidding- Buddy strategy- Fault Tolerant, Scheduling.-Aperiodic scheduling - Spring algorithm.	8
III	**REAL TIME COMMUNICATION :** Introduction – VTCSMA – PB CSMA- Deterministic collision resolution protocol-DCR for multi packet messages-dynamic planning based-Communication with periodic and aperiodic messages.	8
IV	**REAL TIME DATABASES :** Basic Definition, Real time Vs General purpose databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Maintaining Serialization Consistency, Databases for Hard Real Time System.	8
V	**REAL-TIME MODELING AND CASE STUDIES :** Petri nets and applications in real-time modelling, Air traffic controller system – Distributed air defence system.	8

Text Books:
1. Jane W. S. Liu, "Real-time systems", 1st Edition, Prentice Hall, 2000.
2. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wiley & Sons,

2004.
3. C. Siva Ram Murthy, G. Manimaran, "Resource management in real-time systems and networks", PHI, 2009.

Reference:

1. C.M. Krishna, Kang G. Shin, "Real Time Systems", Tata Mc. Graw - Hil, 2010.
2. Giorgio C. Buttazzo, "Hard real-time computing systems: predictable scheduling algorithms and applications" , Springer, 2008.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Understand the features and structures of practical Operating System implementations.
CO2: Acquire practical knowledge Real Time Operating Systems used in embedded system.
CO3: Understand the use of multitasking techniques in Real Time Systems.
CO4: Compare different scheduling algorithms and the schedule ability criteria.
CO5: Analyze real time systems with regard to keeping time and resource restrictions.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)**	**Year: III** **Semester: VI**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Cyber Security Lab**
Course Code: BCS-NEP-605P	**Title: Cyber Security Lab**

Course Objectives:
CO1: Provide practical application of cyber security concepts learned in theory.
CO2: Familiarize students with a wide range of security tools and technologies used in the field.
CO3: Emphasize ethical and legal considerations in the field of cyber security.
CO4: Stay updated with the latest trends, threats, and advancements in cyber security.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=2Credits)

Unit	Contents	No. of Lectures Allotted
I	Checklist for reporting cybercrime at Cybercrime Police Station.	2
II	Checklist for reporting cybercrime online.	2
III	Basic checklist, privacy and security settings for popular Social media platforms.	2
IV	Checklist for secure net banking.	2
V	Setting and configuring two factor authentication in the Mobile phone.	2
VI	Installation and configuration of computer Anti-virus.	2
VII	Wi-Fi security management in computer and mobile.	2
VIII	Setting and configuring two factor authentications in the Mobile phone.	2

Reference / Text Books:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.
2. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt. Ltd.
3. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
4. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
5. Fundamentals of Network Security by E. Maiwald, Mc.Graw Hill.

If the course is available as Generic Elective then the students of following departments may opt it.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-

5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to :

CO1: After completion of this module, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2: Students, at the end of this module, should be able to understand the cybercrimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

CO4: After the completion of this module, students would be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

CO5: Students, after completion of this module will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)**	**Year: III** **Semester: VI**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Artificial intelligence lab(SPT-IV)**
Course Code: BCS-NEP-412P	**Title: Artificial intelligence lab**

Course Objectives:
CO1: Ability to apply standard practices and methodologies in software development and project management.
CO2: Apply various search algorithms of artificial intelligence.
CO3: Understand the concept of Artificial intelligence.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a program in prolog to implement simple facts and Queries	2
II	Write a program in prolog to implement simple arithmetic	2
III	Write a program in prolog to solve Monkey banana problem	2
IV	Write a program in prolog to solve Tower of Hanoi	2
V	Write a program in prolog to solve 8 Puzzle problems	2
VI	Write a program in prolog to solve 4-Queens problem	2
VII	Write a program in prolog to solve Traveling salesman problem.	2
VIII	Write a program in prolog for Water jug problem	2

Reference / Text Books:
1. Elaine Rich & Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. Dan W. Patterson, *"Introduction to Artificial Intelligence & Expert Systems"*, PHI.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: To understand the concept of Artificial intelligence.
CO2: To understand the design principles of pattern recognition with estimation and apply classification technique.
CO3: To apply knowledge representation and reasoning techniques.

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Ordinance & Academic Regulations
B.Sc. -CS (Data Science)
(Academic Handbook 2025-26)

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1. PREAMBLE

As the technological enhancement and availability of technology to every person of world a huge demand of computer skilled professional is ample. In this world of opportunities, impact of higher education is so inevitable for getting desired guidance to secure, right kind of employment. It is compulsory to pursue higher related education in the best institutes. In this direction major reforms are to opt Learning Outcomes-based Curriculum Framework (LOCF), specially, in the undergraduate education (UG) program, that ensure student centric, interactive and outcome-oriented goals, objectives and skill enhancement to acquire. LOCF along with National Education Policy (NEP) in this regard ensure uniform education fabric of standard and content delivery education all over the nation. This syllabus development is a step to ensure development of the undergraduates for both, academia and employability. Latest technical trends, industry standards, market needs, and interests of students, future expectations the need has been taken into consideration while developing the syllabus.

The LOCF inculcation is to build up a comprehensive course structure with detailed syllabus. This is an effort to develop a student centric framework where they are expected to have a concrete understanding of fundamentals of computer science along with the latest trends and techniques like Artificial Intelligence, Internet of Things (IoT), Machine Learning (ML) with advanced skill sets that include Mobile Application environment, Object Oriented Programming (OOPs) among many courses. Each course aims to present learning targets and objectives, and thus provide learning and teaching strategies, assessment and resources. The students shall be equipped with the latest trends in computer science, after completion of the programme.

With this an education temple of nation should ensure an environment, which should be bias free, irrespective of cast, religion, races, sex difference and easily available to youths of the nation. The human value, ethics and environmental teaching is also introduced with this.

2. DEFINITIONSANDNOMENCLATURE

In these Regulations, context otherwise requires:

1. "Programme" means Degree Programme like Bachelor of Computer Science (B.Sc.-CS). Hence further B.Sc.-CS and B.Sc.-CS (Data Science) will call B.Sc.-CS in this document.
3. "GPA" means Grade Point Average.
3. "Course" means a theory or practical subjects that are normally studied in a semester.
4. "VC, Vice-Chancellor of IIMT-University" means the Head of the University.
5. "Registrar" is the Head of all academic and General Administration of the University.
6. "Dean" means the authority of the school who is responsible for all academic activities of various programmes and implementation of relevant rules of these Regulations pertaining to the Academic Programmes.
7. "COE, Controller of Examinations" means the authority of the University who is responsible for all activities related to the University Examinations, publication of results, award of grade sheets and degrees.
8. "Dean – Student Welfare" is responsible for all student related activities including student discipline, extra and co–curricular activities, attendance and meetings with class represent actives, Student Council, and parent–teacher meeting.
9. "HoD" means the Head of the Department concerned.
10. "University" means IIMT-University, Meerut.
11. "TCH" means Total Contact Hours–refers to the teaching–learning periods.
12. "DEC" means Department Exam Committee.

13. "BoS" means Board of Studies.
14. "ACM" means Academic Council Meeting the highest authoritative body for approval for all Academic Policies.
15. "Class Coordinator" is a faculty of the class who takes care of the attendance, academic performance, and the general conduct of the students of that class.
16. "IA" is Internal Assessment, which is assessed for every student for every course during the semester.
17. "ESE" is End Semester Examination conducted by the University at the End of the Semester for all the courses of that semester.
18. "UGC" means University Grants Commission.
19. "MHRD" means Ministry of Human Resource Development, Govt. of India.
20. "AICTE" means All India Council of Technical Education.
21. "HEI" means Higher Education Institutions.
22. "PRN" means Permanent Registration Number.
23. "CGPA" means Cumulative GPA.
24. "SGPA" means Semester GPA.
25. "NC" means Non-Credit.

3. VISION AND MISSION OF THE SCHOOL

VISION

To achieve heights in computer education domain by creating appropriate environment for students, faculties and staff with availability of latest technological infrastructure.

MISSION

1. To dissipate appropriate all types of practical and theoretical computer science knowledge to our young students.
2. Inculcate professional efficiency in the students for brighter career opportunity as per industry latest requirement.
3. To provide learning environment for students with our reputed academics partner in the field of computer science.
4. To prepare our student as an IT professional with full of ethics and human values.

4. PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: The graduates are designed to produce skill graduates who will be competent professionals in academics, industry and organizations of government and private sector.

PEO2: The pass out graduates will be able to handle the fast-changing world requirements and will become effective professionals.

PEO3: The successful Graduates will be a good team leader and will be able to lead the team to find optimal solutions and achieve expertise in their field or become entrepreneurs and play the leading roles in all types of organizations.

5. PROGRAM OUTCOMES (PO'S)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate

consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

6. PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1: To equip the graduates with practical knowledge and give hands on experience to them.

PSO2: To expose the students to the basic concepts of integration, differentiation, vector calculus, probability & statistics, and discrete mathematics.

PSO3: To equip graduates with the study of design, development and analysis of software.

PSO4: To aware graduates about the benefits of data storage and create awareness of new trends in database management system.

7. ADMISSION

Hence further B.Sc.-CS and B.Sc.-CS (Data Science) will be called B.Sc.-CS in this document. The admission policy and procedure shall be decided from time to time by the University based on the guidelines issued by the UGC/ Ministry of Education, Government of India. Seats are also made available for Non-Resident Indians and foreign nationals, who satisfy the admission eligibility norms of the University as per the UGC Norms.

8. ELIGIBILITY IN ALL YEARS AS PER NEP (ENTRY)

8.1 Candidate should have passed "10+2" exam (recognized board) in any stream with at least 40% in aggregate.

8.2 Admission will be based on academic record.

8.3 The Academic Council shall have power to amend or repeal the eligibility criteria laid down at clause 8.1& 8.2, if required.

9. CURRICULUM

The curriculum for Bachelor of Computer Science Programme is designed to have minimum and maximum credits as per the scheme of 120-160 credits that are distributed across six semesters of study for the award of degree.

10. MEDIUM OF INSTRUCTION

The medium of instruction is ENGLISH for all courses, examinations, seminar presentations and project reports.

11. CHOICE BASED CREDIT SYSTEM (CBCS)/ LOCF/ OBE

11.1 The three-year curriculum has been divided into six semesters. Semester Ist to VIth shall include lectures, tutorials, practical, seminars and project work as defined in the scheme of instruction and examination issued by the University from time to time.

11.2 The curriculum will be also including such other curricular, co-curricular and extra- curricular activities as may be prescribed by the University from time to time. Credit System BCA programme will have a curriculum in which every course will be assigned certain credits reflecting its weight and contact periods per week, as given below:

1 Lecture period (L) per week = 1 Credit
1 Tutorial period (T) per week = 1 Credit
1 Practical period (P) per week = 0.5 Credit

In addition to theory and laboratory courses there may be other courses such as seminar, project etc., which will be assigned credits as per their contribution in the programme without regard to contact periods.

11.3 Minimum Credit Requirements

The minimum credit required for award of a B.Sc.-CS degree is 120**.** This is normally divided into theory courses, tutorials, laboratory courses, seminars and projects in duration of six semesters. The credits are distributed semester wise as shown in the structure and syllabus manual of the programme. Courses generally progress in sequences, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester wise schedule of courses given in the syllabus manual of the programme.

11.4 Course Categories

Under CBCS, the degree programme will consist of the following categories of courses as per following table:

Table 11.4 - Distribution of Credits (Evaluation Scheme)

S. No.	Category	As per Format 1 & 2 of CBCS
1.	Core Course (Theory)-CC	
2.	Core Course (Practical)-CC(P)	
3.	Discipline Specific Elective (Theory)- DSE	

4.	Generic Elective (Theory)-GE	
5.	Ability Enhancement Compulsory Courses-AECC	
6.	Skill Enhancement Courses-SEC	
7.	Research Project (RP)	

11.5 Curriculum Structure

The curriculum for B.Sc.-CS will contain a listing of all courses, with each course having a course category, course number, course title, number of contact periods per week, number of credits assigned, and the marks assigned to various components of evaluation.'

11.6 Approval of the Curriculum

The curriculum for B.Sc.-CS programme will be prepared by the Department concerned and will be approved by the Board of Studies of the Department. The Academic Council for final approval and then the Curriculum will be implemented. Same procedure shall be used for any modification in the Curriculum.

12. REGISTRATION FOR A COURSE IN A SEMESTER

A student will be eligible for registration of courses only if he/she satisfies the regulation (progression), and has cleared all dues to the University, Hostel and Library up to the end of the previous semester if student is not debarred from enrolment on disciplinary grounds.

The university follows a flexible Choice Based Credit System and slot-based table. Accordingly, the students shall be given the option for selecting their courses, credits, teachers, slots and create their timetable. The student is given the option of selecting the number of credits to undergo in a semester, subject to the curriculum requirements.

Except for the first-year courses, registration for a semester will be done during a specified week before the start of the semester as per the academic calendar.

Late registration /enrolment will be permitted by the Dean of the School for genuine cases, on recommendation by the Head of the respective department, with a late fee as decided from time to time.

The student shall make the choice of course in consultation with the Class Coordinator and as stipulated from time to time.

Students shall have to pay additional fee as prescribed, for registering in certain elective courses under Generic Electives courses offered by certain specific departments and for higher level Foreign Languages, as decided from time to time.

13. ATTENDANCE

The faculty handling a course must finalize the attendance, three calendar days before the last instructional day of the course and submit to the HoD through the class teacher.

13.1 Condonation of Medical Cases

a. A student with less than 75% attendance (Total Contact Hours -"TCH") in any course, will not be permitted to appear for the end-semester examination in that course, irrespective of the reason for the shortfall of the attendance. The student is however permitted to avail Academic Leave up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD. After the event, the student should submit the relevant documents for proof to the HoD for approval of the Academic Leave.

b. The remaining 25% allowance in attendance is given to account for activities under NCC / NSS / Cultural / Sports/ Minor Medical exigencies etc.

c. Students under "CO (Carry Over)" category in any course shall attend the immediately following Summer/Winter course. The detailed schedule of the Summer/Winter courses offered in every semester will be announced during the end of that semester. The students who have obtained "CO (Carry Over)" has to select their appropriate slots and courses, optimally to attend the courses.

13.2 Additional Condonation

Additional Condonation may be considered in rare and genuine cases which includes, approved leave for attending select NCC / Sports Camps, cases requiring prolonged medical treatment and critical illness involving hospitalization. For such select NCC / Sports Camps prior permission for leave shall be obtained by the respective Dean / Director of sports from the designated authority, before deputing the students.

For medical cases, submission of complete medical history and records with prior information from the parent / guardian to Dean (Students Welfare) DSW is mandatory. The assessment of such cases will be done by the attendance sub – committee on the merit of the case and put-up recommendations to the Vice – Chancellor. Such condonation is permitted only twice for a student in the entire duration of the programme.

The Vice-Chancellor, based on the recommendation of the attendance sub-committee may then give condonation of attendance, only if the Vice-Chancellor deems it fit and deserving. But in any case, the condonation cannot exceed 10%.

14. ASSESSMENT PROCEDURE

14.1 Internal Assessment (IA) – 25 Marks & External Assessment (EA) - 75 Marks

14.2 Practical Assessment (as per format 1 and 2)

15. RESEARCH PROJECT/SEMESTER PROJECT – ASSESSMENT CRITERIA

The general guidelines for assessment of Project are given in Table 15.1

Table 15.1: Assessment pattern for Research Project / Semester Project

S. No.	Review / Examination scheme	Broad Guidelines	Weightage
1	First Review	Concept	10%
2	Second Review	Design	10%
3	Third Review	Experiment/Analysis	20%
4	Final Review/ESM	Project report and Viva – Voce, Results and Conclusion	60%

16. INTERNSHIP – RESEARCH/INDUSTRIAL INTERNSHIP

A student has to compulsorily attend summer internship at the end of 4th semester for a minimum period of 30 days. In lieu of Summer-Winter internship, the student is permitted to register for undertaking project work under a faculty of the University and carry out the project for minimum period of 30 days. In both the cases, the internship report in the prescribed format

duly certified by the faculty in-charge shall be submitted to the HoD. The evaluation will be done through presentation and viva. The course will have a weight age as defined in the respective curriculum.

For the final year project and viva-voce end semester examination, the student shall submit a project report in the prescribed format issued by the University. The reviews will be conducted by a committee constituted by the HoD. The end semester assessment will be based on the project report and a viva on the project conducted by a committee constituted by controller of examination. This may include an external expert.

17. FOR NON – CGPA COURSES/AUDIT COURSES

The Assessment will be done based on the respective assessment as per rubrics issued by the HoD.

A student securing less than the minimum specified internal assessment marks in any course will not be permitted to appear for the end-semester examination in that course and will be graded under "CO (Carry Over)" category for that course. This will be denoted in the grade sheet as "CO (Carry Over)", till the course is successfully completed in the subsequent semester(s).

18. CREDIT WEIGHTAGE

Credits are the weightage, assigned to the courses based on the following general pattern:

One Hour	1 credits
Two Hour Practical	0.5 credits

19. MAXIMUM DURATION OF THE PROGRAMME /PROMOTION POLICY

A student may complete the programme at a slower pace than the regular pace, but in any case, in not more than **N+2 years**.

A student completing the degree programmes in the extended period will not be eligible for university ranking.

20. MAXIMUM GAPS BETWEEN SEMESTER/YEAR

A student may be permitted by the Vice-Chancellor to withdraw from the entire programme for a maximum of two semesters for reasons of ill health, start – up venture or other valid reasons as recommended by a committee consisting of Head of Department, Dean of School and Dean (Student Welfare).

21. CREDIT SYSTEM & GRADING CGPA/SGPA

Introduction

IIMT University implemented the UGC guidelines to implement of the choice-based credit system with a view to offer student's choice of courses within a programme with a flexibility to complete the programme by earning credits at a pace decided by the students themselves. The system allowed students to choose inter-disciplinary, intra-disciplinary courses according to their learning needs, interest and aptitude. It was considered as a cafeteria approach and was expected to provide mobility to students.

21.1 Credit System

As per the current credit system practiced in institutions needs comprehensive reforms as they offer very little flexibility, choice and are less learner centric. Degrees offered today are more self-contained focusing on a specialization area and depend a lot on knowledge available with

the faculty from the department only. Though the most requisite credit system does exist, wherein students are given a wide choice and flexibility, these exist as small islands in the vast ocean of thousands of educational institutes in India. In such institutions, the curriculum is frequently designed which is learner centric and offering a wide specialization area for students to pick and choose courses from.

The institutions shall make attempts wherein the design of the credit system and the teaching and evaluation modes shall be the responsibility of individual course teachers. The students should have the freedom to opt for courses from other specializations and not just from their core specialization. For this there has to be stronger collaborations between departments of the University and outside.

21.2 Grading system

Most institutions follow the absolute grading system which is a simple procedure wherein the marks obtained by students correspond to a specific grade and grade point. It reflects the individual performance in a particular subject without any reference to the group/class. The absolute grading system has limitations and may be susceptible to some inconsistencies.

The relative grading system on the other hand provides relative performance of a student to a group/class wherein the student is ranked in a group/class on basis of relative level of achievement. In this system decisions are made in advance by the faculty members as to what proportion of students would be awarded a particular grade on the basis of their relative performance and which is done by assigning grades on basis of a normal curve. This facilitates comparative performance and eliminates negative effect of pass or fail.

Relative grading system may be used if the number of students registered for the course is at least 30. For a class of smaller size, an absolute grading scheme may be used. The statistical method may be used with adjustments to calculate the mean (M), median (Md) and standard deviation (SD) of the total marks (TM) obtained by the students registered for the course. If the mean and median coincide, the mean may be used for further computations, otherwise the median may be used. If suppose the mean is used, then the letter grades may be awarded based on the ranges specified in table below:

A grading system as shown in given table-

Table 21.2: Grading System

Letter Grade	Range
A+	TM>M+1.75SD
A	M+1.25 SD ≤TM<M+1.75SD
B+	M+0.75 SD ≤TM<M+1.25SD
B	M+0.25 SD ≤ TM < M+0.75 SD
C+	M-0.25 SD ≤ TM < M-0.25 SD
C	M-0.75 SD ≤ TM < M-0.25 SD
D+	M-1.25 SD ≤ TM < M-0.75 SD
D	M-1.75 SD ≤ TM < M-1.25 SD
E+	M-2.0 SD ≤ TM < M-1.75 SD
E	M-2.25 SD ≤ TM < M-2.0 SD
F	M-2.25 SD > TM
CO	Carry Over (Summer / Winter) due to Attendance deficiency (between 40% and 75%)and/or

	I. Lack of minimum IA marks as specified in clause 10.0 Table 3.
RA	Repeat the course due to (i) Lack of minimum attendance (below 40%) in regular course.
--	DETAINED "RC" or "RA" or both in all registered theory courses of a semester. The student is detained and has to repeat the entire semester. Clause 12.3

Letter grades may be improved based on the following scheme: Use the table above to determine grade boundaries. Look for natural gaps in the neighborhood of grade boundaries. Choose the largest gap in the neighborhood and make this as the grade boundary.
An 'E', 'E+' and 'F' grade may not be a purely relative grade. These may be assigned on the following basis:

- A minimum, say 30/100, may be set as pass marks for the course. A failure grade may then be awarded only if the Total Marks for the course are less than 30. Otherwise, the students may be awarded the Just Pass Grade D.
- A failure grade may be awarded to students whose marks are below the prescribed minimum even if the table above leads to a pass grade.

Similarly, a lower limit may be set for the A grade also, for instance greater than or equal to 86. Students not achieving the prescribed minimum may be awarded a lower letter grade even if the table above indicates otherwise. A pass grade may be made mandatory for both internal as well as external examinations in the case of a separate internal and external assessment,

a. Internal and External marks may be summed up with appropriate weightage to compute a total out of 100 marks. The letter grade may be assigned on this computed total.
b. Internal and external marks may be graded separately and then the assigned grade points may be used, with appropriate weightage, to compute a final grade point and letter grade.

Grading in the case of Re-evaluations, Retests and Remedial Examinations may be based on the following guidelines:

a. The ranges of marks once computed for awarding letter grades the first time, called the First Distribution (FD), will not be modified.
b. If a re-evaluation leads to a change in marks, then FD will be used to award an appropriate letter grade.
c. A retest may be permitted, if
    i. A student gets a letter grade of E+ or E. In this case, irrespective of the marks obtained, at most D grade may be awarded.
    ii. A student is unable to complete course requirements because of certified illness or tragedy. In this case FD will be used to award an appropriate letter grade.

The use of relative grading system may be recommended in autonomous institutions, institutes of national importance and institutions with high ranking. The results of the relative grading system may be shared by such institutions later with other interested institutions to implement the same.

21.3 GPA and CGPA

GPA is the ratio of the sum of the product of the number of credits Ci of course "i "and the grade points Pi earned for that course taken over all courses "i" registered and successfully completed by the student to the sum of Ci for all "i". That is,

$$GPA = \frac{\sum_i C_i P_i}{\sum_i C_i}$$

CGPA will be calculated in a similar manner, in any semester, considering all the courses enrolled from the first semester onwards.

21.2 The Grade card will not include the computation of GPA and CGPA for courses with letter grade CO, RC and U until those grades are converted to the regular grades.

21.3 A course successfully completed cannot be repeated.

Grade Sheet

Letter grade

Based on the performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and corresponding grade points are given in Table 8.
A student is considered to have completed a course successfully and earned credits if he/she secures a letter grade other than F, CO, RA in that course.
After results are declared, grade sheet will be issued to each student which will contain the following details:

a. program and discipline for which the student has enrolled.
b. Semester of registration.
c. The course code, name of the course, category of course and the credits for each course registered in that semester
d. The letter grade obtained in each course
e. Semester Grade Point Average (GPA)
f. The total number of credits earned by the student up to the end of that semester in each of the course categories.
g. The Cumulative Grade Point Average (CGPA) of all the courses taken from the first semester.

Credits earned under Non CGPA courses.

22. CLAS/DIVISION

22.1 Classification is based on CGPA and is as follows:

CGPA ≥ 8.0	: **First Class with distinction**
6.5 ≤ CGPA <8.0	: **First Class**
5.0 ≤ CGPA <6.5	: **Second Class**

22.2 (i) Further, the award of 'First class with distinction' is subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses in his/her first appearance with effect from II semester, within the minimum duration of the programme.

(ii) The award of 'First Class' is further subject to the candidate becoming eligible for the award of the degree having passed the examination in all the courses within 3 years for Bachelor of Computer Application.

(iii) The period of authorized break of the programme (vide clause 11.0) will not be counted for the purpose of the above classification.

23. TRANSFER OF CREDITS/ACADEMIC CREDIT BANK

23.1 "Credit-transfer" means the mechanism by which the eligible HEIs registered with ABC are able to receive or provide prescribed 'credits' to individual registered ABC account in adherence to the UGC credit norms for the 'course/s' registered by the desirous students in any eligible higher education institution within India.

23.2. Within the broad framework of these regulations, the Academic Council, based on the recommendation of the Credit Transfer Committee so constituted may permit students to transfer part of the credit earned in other approved Universities of repute & status in the India or abroad.

23.3 The Academic Council may also approve admission of students who have completed a portion of course work in another approved Institute of repute under Multiple entry & Exit system, based on the recommendation of the credit transfer committee on a case-to-case basis.

23.4 Students who have completed coursework, at least first year, at some university other than the university to which transfer is to be sought, may request for transfer of admission to this university. A student may be granted admission only through an admission process that will follow the same policy as for fresh admissions. However, a uniform credit system must be followed by all universities to effect transfer of credits.

23.5 Credit Transfer request can be submitted only after the student has been admitted in the concerned program and the following conditions are met:
University Grants Commission initiated the concept of National Academic Credit Bank (NAC-Bank) which will be a digital / virtual / online entity to be established and managed by UGC. The main objective of the NAC-Bank would be to facilitate student mobility across the education system wherein the credits can be accumulated and be used at alter point of time for the requirements of partial fulfillment of a degree program.

i. The course work has been completed at a UGC approved and accredited University through fulltime formal learning mode.
ii. The university accreditation grade/ ranking is not lower than that of the university to which the transfer is sought.
iii. The courses prescribe to the common minimum syllabus under UGC CBCS system.
iv. The letter grade obtained in the courses is "B" or better.
v. The number of credits to be transferred does not exceed the prescribed limit.
vi. The program in question must have a similar credit system, in particular, modular or semester and the same numeric and letter grading system along with common meaning of the term "credit" in numerical terms.

The aspect of shelf life of courses needs to be considered while accepting credits as obsolescence of knowledge of certain field in terms of its current relevance needs to be investigated. The time elapsed between successful completion of certain courses of the program and the admission to which program transfer is sought needs to be considered. The maximum number of credit points that may be considered under a credit transfer needs to be specified. Contextual variables such as teaching-learning approach adopted, learning facilities offered, use of evaluation modes may also be considered while preparing the credit transfer policy.

Moderation

Moderation of assessment is an organized procedure which ensures use of valid assessment material and consistent application of criteria, to provide fair academic judgment and reliable outcome in the form of marks or grades. It assures appropriate designing and implementation of assessment activities along with generation of valid and reliable results.

Integration of moderation process with assessment system is imperative for the development of academic quality in higher educational institutions as:

- It addresses any difference in individual judgments of different evaluators.
- It ensures that all achievements in the form of marks and grades across courses reflect achievement of same level of standard.
- It is also carried out to develop a common understanding of the standards and criteria and to recognize performance which demonstrates that standard or fulfils those criteria.

Moderation may be conducted in case there are large number of fail grades or high grades, or when large numbers of students who have received the same grade or clustering of students on letter grades, or when there are discrepancies between grades allocated to individual students in different courses, or to find out the difficulty level of the question paper or whether the assessments modes used cover the entire syllabus or not.

pplicability - Moderation will be made applicable to both external and internal modes of assessment. All programs and courses will indicate, as part of their statements on assessment, arrangements for the moderation of assessed work. This can be done through formulation of a moderation policy and implemented across all programs and courses of instruction and delivery. The time frame for the moderation will be linked with the time frame for assessment.

In the event moderation is triggered, an evaluation will begin with a discussion on the following (though not exhaustive) lines:

a. What are the rubrics used for each of the different types of assessment in the course? Is a standardized/ prescribed rubric used or has the instructor developed his/ her own rubric. If the instructor is using a personally framed rubric, or if there is no identified rubric, then how does the assessment map to learning outcomes?

b. The difficulty level of the questions included in the assessments, i.e., is the difficulty level on the extremes, very easy or very hard.

c. The manner of awarding marks, i.e., has the correction been at the extremes, liberal or tough.

Each department will establish a committee and designate roles and responsibilities at different levels for smooth working of the moderation process. In order to maintain neutrality, it will be ensured that moderator should not be the assessor. Staff members will be trained professionally in assessment techniques and moderation procedures. All assessment material produced by learner including examination sheets, assignments, project reports, research reports etc. will be examined.

Institutions will be encouraged to make the moderation process online. In this system, assessment plans, moderation plans, assessment tools, samples of which may be submitted online. Moderation reports will be generated online so that progress can be tracked and submitted to the CoE after the approval of Dean and HoD. The moderation will not be restricted to just assessment but also include moderation of content and assessment design.

24. CHANGE OF DISCIPLINE

"Academic Flexibility" is the provision for innovative and interchangeable curricular structures to enable creative combinations of Courses/Programmes in Disciplines of study leading to Degree/Diploma/PG Diploma/Certificate of Study offering multiple entry and multiple exit facilities in tune with National Education Policy-2020, while removing the rigid curricular

boundaries and creating new possibilities of life-long learning.

25. USE OF TECHNOLOGICAL INTERVENTIONS

With the proliferation of different types of access devices, especially mobile access devices, technology has the potential to augment traditional classroom practices and revolutionize learning and evaluation methods. Technology, in fact can be an important driver to enable lifelong learning. Learning and engagement of students is facilitated by use of technology through several modes such as synchronous learning, semi-synchronous learning, blended learning, collaborative learning, flipped classroom etc. MOOC's, especially provided through SWAYAM, are a window of opportunity for lifelong learning and are offered through technology-based platforms. Learning management systems (LMS) may be used by institutions to integrate the entire teaching, learning and evaluation process. The Learning Management System may be used by institutions to deliver academic content in blended form and to assess learning through thesis, assignments etc. Open-source learning management systems such as *Moodle, Edmodo* may be used for posting content in the form of videos, audios, e-learning modules, live class sessions etc. Use of plagiarism detection software will be highly recommended to check originality of the content.

In the conduct of examinations, universities face tremendous challenges such as need for trained manpower, distribution of question paper without delays and errors, delays in evaluation of answer scripts, lack of infrastructure to conduct examinations at a large scale, non-availability of faculty members for assessment, security issues faced during paper setting and paper distribution, tampering of certificates and answer scripts etc.

For a typical examination department of an institution will be an autonomous body right from registration of student to convocation through an integrated system. In fact, steps must be taken to implement a complete examination management system that considers the complete life cycle of examination process. The use of technology will reduce dependency on human intervention and be error free. The following functions will be automated:

i. Registration of students and generating unique PRN,
ii. Filling up of examination form,
iii. Generation of seat numbers and admit cards/hall tickets,
iv Preparation of list of paper setter,
v. Use of question bank system to draw question sets, question paper generation,
vi. Online distribution of question papers on the day of examination with system of encryption,
vii. Barcode system for answer books (this will eliminate issues related to errors, avoid malpractices etc.),
viii. Digitization of answer scripts and onscreen evaluation of answer sheets,
ix. Tracking of student's performance,
x. Marks submission through online software,
xi. Viewing of result through online system,
xii. Online verification and revaluation system,
xiii. Digitization of certificates and mark sheets (to avoid tampering and easy retrieval),
xiv. Certificate authentication system,
xv. Submission of various other applications through online system.

The above will lead to conduct of functions of the examination system in an efficient and transparent manner and timely availability of information to students.

26. STUDENT DISCIPLINE

Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige reputation of the University and School.

27. STUDENT WELFARE

Any act of indiscipline of a student reported to the Dean (Students Welfare) and Head of the Department will be referred to a Discipline Committee constituted for the purpose. The Committee will enquire into the charges and decide on a suitable punishment if the charges are substantiated. The committee will also authorize the Dean (Students Welfare) to recommend to the Vice-Chancellor for the implementation of the decision. The student concerned may appeal to the Vice-Chancellor, whose decision will be the final.

28. RAGGING

Ragging in any form is a criminal and non-bailable offence in our country. The current State and Central legislations provide stringent punishments including imprisonment. Once the involvement of a student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the University, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student at the University, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

29. POWER TO MODIFY

Not with standing all that has been stated above, the Academic Council is vested with powers to modify any or all the above regulations from time to time, if required, subject to the approval by the Board of Studies and final approval by Vice-Chancellor.

30. EXIT POINT

Exit point will be governed as per format 1 and format 2.

31. NC/CREDIT COURSE

For non-credit courses ‘Satisfactory’ or ‘Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

Evaluation Scheme

B. Sc. (COMPUTER SCIENCE/DATA SCIENCE)
Year: I / Semester: I

S. No	SubjectCode	Subject Name	Course Type	Evaluation Scheme							
				Course Type	Periods			Internal Marks	External Marks	Total Marks	Credits
					L	T	P				
1	25BCS-DS101	Problem solving techniques using 'C' Language	C1	PP	3	0	0	25	75	100	3
2	24BCS-DS102	Probability and Statistics	C2	PP	4	0	0	25	75	100	4
3	24BCS-DS103	Basics of Computers and Recent Trends	C3	PP	3	0	0	25	75	100	3
4	24BCS-DS104 24BCS-DS105 24BCS-DS106-3 24BCS-DS107-4	**Select Any One-** 1. ERP 2. M-Commerce 3. Feature Engineering 4. Basics of Data Analytics using Spreadsheet	DSE1	PP	4	0	0	25	75	100	4
5	24BCS-DS106	Office Automation Tools	SEC1	PP	2	0	0	25	75	100	2
6	25BCS-DS107P	Problem solving techniques using 'C' Language Lab	C1 Lab	PR	0	0	2	25	25	50	1
7	24BCS-DS108P	Office Automation Tools Lab	SEC1	PR	0	0	2	25	25	50	1
8	BCS-DS109P	Basics of Computers and Recent Trends Lab	C3 LAB	PR	0	0	2	25	25	50	1
9	NHU-111	English Communication	AECC1	PP	3	0	0	25	75	100	3
10	IEMM-402	Indian Ethos and Modern Management	VAC 1	PP	2	0	0	25	75	100	2
11	SPT-PC-111	Sports			0	0	2	15	35	50	NC
		Grand Total			**21**	**0**	**8**	**265**	**635**	**900**	**24**

C1 - Core Course 1, C2 - Core Course 2, C3 – Core Course 3, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course

B. Sc. (COMPUTER SCIENCE/DATA SCIENCE)
Year: I / Semester: II

S. No	SubjectCode	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	24BCS-DS201	Advance 'C' Programming	C4	3	0	0	25	75	100	3
2	24BCS-DS202	Mathematics -II	C5	4	0	0	25	75	100	4
3	24BCS-DS203 24BCS-DS204 24BCS-DS205-1	Select Any One- 1. Digital Electronics and Computer System Architecture 2. Information System 3. Artificial Intelligence	DSE2	4	0	0	25	75	100	4
4	24BCS-DS205	Linux Administration with Scripting	C6	3	0	0	25	75	100	3
5	24BCS-DS206P	Advance C Programming Lab	C4 Lab	0	0	2	25	25	50	1
6	24BCS-DS207P	Digital Electronics and Computer System Architecture Lab	DSE2 Lab	0	0	2	25	25	50	1
7	24BCS-DS208P	Linux Administration with Scripting Lab	C6 Lab	0	0	2	25	25	50	1
8	NHU-NPR-112	Environment and Ecology	AECC2	4	0	0	25	75	100	4
9	NHU-NPR-112P	Environment and Ecology Lab	AECC2 Lab	0	0	2	25	25	50	1
10	Code to be obtained form NPTEL	IPR/E&I to be completed form NPTEL, registration to be Initiated in January	SEC2	0	0	4	0	0	0	2
11	Code to be provided from other Schools of IIMTU	Generic Elective (To to be opted from other Schools of IIMTU)	GE1	4	0	0	25	75	100	4
12	SPT-PC-211	Sports		0	0	2	15	35	50	1
		Grand Total		**22**	**0**	**14**	**265**	**585**	**850**	**29**

C4 - Core Course 1, C5 - Core Course 2, C6 – Core Course 3, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project VAC- Value Added Course IPR : Intellectual Property Rights , E&I : Entrepreneurship and Innovation
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non Credit Course

B.Sc. COMPUTER SCIENCE (DATA SCIENCE)
Year: II / Semester: III

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	25BCS-DS301	Data Structure and Algorithms using 'C'	C7	3	0	0	25	75	100	3
2	25BCS-DS302	Operating Systems	C8	3	0	0	25	75	100	3
3	25BCS-DS303	Data Science using Python	C9	3	0	0	25	75	100	3
4	25BCS-DS304-1 25BCS-DS304-2	**Select Any One-** 1. Block Chain 2. Data Mining and Data Warehousing	DSE-3	4	0	0	25	75	100	4
5	25BCS-DS305	Basics of SQL	SEC-3	2	0	0	25	75	100	2
6	25BCS-DS306	Cyber Security	VAC-2	3	0	0	25	75	100	3
7	25BCS-DS301P	Data Structure and Algorithm using 'C' Lab	C7 Lab	0	0	2	25	25	50	1
2	25BCS-DS302P	Operating Systems Lab	C8 Lab	0	0	2	25	25	50	1
8	25BCS-DS303P	Data Science Lab	C9 Lab	0	0	2	25	25	50	1
9	25BCS-DS305P	Basics of SQL Lab	SEC-3	0	0	2	25	25	50	1
10	UVE-401	Universal Human values & Professional Ethics	AECC-3	3	0	0	25	75	100	3
11	Code to be provided from Schools of IIMTU	Generic Elective (To be opted from other Schools of IIMTU)	GE-2	4	0	0	25	75	100	4
12	SPT-PC-311	Sports		0	0	2	15	35	50	NC
		Grand Total		**25**	**0**	**10**	**315**	**735**	**1050**	**29**

C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course

B.Sc COMPUTER SCIENCE (DATA SCIENCE)
Year: II / Semester: IV

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	25BCS-DS401	OOPs using Java	C10	3	0	0	25	75	100	3
2	25BCS-DS402	Software Engineering	C11	3	0	0	25	75	100	3
3	25BCS-DS403	Machine Learning	C12	3	0	0	25	75	100	3
4	25BCS-DS404-1 25BCS-DS404-2 25BCS-DS404-3	Select Any One- 1. IOT 2. Mobile Application Development 3. Python Programming	DSE-4	4	0	0	25	75	100	4
5	25BCS-DS405	E&I/IP through NPTEL	SEC-4	0	0	4	0	0	0	2
6	25BCS-DS401P	OOPs using Java Lab	C10 Lab	0	0	2	25	25	50	1
2	25BCS-DS402P	Software Engineering Lab	C11 Lab	0	0	2	25	25	50	1
7	25BCS-DS403P	Machine Learning Lab	C12 Lab	0	0	2	25	25	50	1
8	25BCS-DS406	Professional Skills	AECC-4	3	0	0	25	75	100	3
9	Code to be provided from Schools of IIMTU	Generic Elective (To be opted from other Schools of IIMTU)	GE-3	4	0	0	25	75	100	4
10	SPT-PC-411	Sports		0	0	2	15	35	50	1
		Grand Total		**20**	**0**	**8**	**240**	**560**	**800**	**26**

C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project, L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course

B.Sc. COMPUTER SCIENCE (DATA SCIENCE)
Year: III / Semester: V

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	BCS-NEP-511	SPT-V	C1	4	0	0	25	75	100	4
2	BCS-NEP-513	SPT-VI	C2	4	0	0	25	75	100	4
3	BCS-NEP-503	1. Data Communication Network 2. ERP 3. Big Data	DSE	4	0	0	25	75	100	4
4	RP-I AUDIT	Research Project-I@	AUDIT	2	0	0	50	0	50	NC
5	BCA-NEP-IP-I	Internship	Industrial Internship (Mandatory)	0	0	10	50	0	50	5
6	BCS-NEP-512P	SPT-V Lab	CORE LAB 1	0	0	4	25	25	50	2
7	BCS-NEP-514P	SPT-VI Lab	CORE LAB 2	0	0	4	25	25	50	2
		Grand Total		**14**	**0**	**18**	**275**	**175**	**500**	**21**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										
NOTE: @RESEARCH PROJECT – II is a Noncredit course (Audit Courses) and Student needs to qualify it but the marks will not be added in total marks.										

B.Sc COMPUTER SCIENCE (DATA SCIENCE)
Year: III / Semester: VI

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	BCS-NEP-611	SPT-VII	C1	4	0	0	25	75	100	4
2	BCS-NEP-613	SPT-VIII	C2	4	0	0	25	75	100	4
3	BCS-NEP-603	1. Mobile Computing 2. E-Commerce 3. Real Time System	DSE	4	0	0	25	75	100	4
4	BCS-NEP-IP-II	Industrial Project	Minor Industrial Project	0	0	10	100	0	100	5
5	BCS-NEP-612P	SPT-VII Lab	CORE LAB 1	0	0	4	25	25	50	2
6	BCS-NEP-614P	SPT-VIII Lab	CORE LAB 2	0	0	4	25	25	50	2
7	*Code will be decided by parent department	GE-3(To be opted by the students as per the given electives in the list attached)	GE3(Mandatory)	4	0	0	25	75	100	4
8	BCS-NEP-607P	MOOC	SEC	2	0	0	50	0	50	2
9	RP-II AUDIT	Research Project-II@	AUDIT	4	0	0	50	0	50	4
		Grand Total		**22**	**0**	**18**	**350**	**350**	**700**	**29**
C1 - Core Course 1, C2 - Core Course 2, DSE – Discipline Specific Elective, AECC – Ability Enhancement Compulsory Course, GE – Generic Elective, SEC- Skill Enhancement Course, RP – Research Project										
L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course										
NOTE: @RESEARCH PROJECT – II is a Noncredit course (Audit Courses) and Student needs to qualify it but the marks will not be added in total marks.										

Format-1

Format -1

NEP-2020 IMPLEMENTATION 3 STEPS PLAN (FORMAT-1,2 & 3)
CBCS: Statement of Credits distribution

College/School:SoCSA
Programme:BSC (CS)-DS
Duration: UG (6 Sem.), UG (Hons./Research) 8 Sem., PG (4 Sem.)

Credit range:Minimum 120 for UG
160 for UG (Hons.), 80 for PG
(Suggested by CBCS-NEP Committee)

Course	Credit	Semester	Core Major	DSE Minor	AECC	SEC **	GE Interdisciplinary	General Elective	Value Added Course (VAC)	Industrial Training/ Survey / Research Project	Total Credits
Certificate Course in Computer Science and Data Science.		Ist	**C 1** **1).** C Programming (Th 3+P2) **C 2** **2).** Probability and Statistics (Th 4) **C 3** 3). Basics of Computers and Recent Trends (Th 3+P2)	**DSE 1** **1).**ERP(Th4)/ **2).** M-Commerce (Th 4)	**AECC 1** English Communication (Th. 3)	**SEC 1** Office Automation Tools (Th2 +P2)		GE-1 General Elective (To be opted from other schools of IIMTU) (Th4)			30 (Excluding NCC)
		2nd	**C 4** 1).Advance C Programming (Th3+P2) **C 5** 2). Mathematics-II (Th4) **C 6** 3). Linux Administration with Scripting (Th3+P2)	**DSE 2** 1). Digital Electronics & Computer System Architecture (Th 4)/ 2). Information System (Th4)	**AECC-2** Environment & Ecology (Th 4 P2)	**SEC 2** IPR (Th 2) (Through IIMTU/ NPTEL)		NCC			27 (Excluding NCC)
Entry and Exit point											

Diploma in Computer Science and Data Science		3rd	1). Data Structure and Algorithm using C (Th3+P1) 2). Operating Systems (Th 4) 3). Machine Learning (Th3+P1)	1). Block Chain (Th4)/ 2). Data Mining and Data Warehousi-ng (Th4)	AECC 3- Human values& Professional Ethics (Th. 3 Cr.)	Basics of SQL (Th 1+P1)	GE 2 A/B	NCC	Cyber Security (Th3)		28 (Excluding NCC)
		4th	1). OOPs using Java (Th3+P1) 2). Software Engineering (Th4) 3). Artificial Intelligence (Th 3+P1)	1). IOT (Th 4)/ 2). Mobile Application Development (Th3+P1) 3). Python Programming (Th3+P1)	AECC 4- Professional Skills (Th. 3 Cr.)	E&I (Th 2)	GE 3 A/B	NCC			25 (Excluding NCC)
Entry and Exit point **Note:-** Summer Internship in between 4th and 5th Sem. During session break (6-8 weeks) (Credit-4) and will be evaluated in next Sem.											

B.Sc. in Computer Science and Data Science		5th	1). Theory of Computation (Th 4) 2). Computer Networks (Th 3+P1) 3). Data Science (Th3+P1)	1). Natural Language Processing (Th4)/ 2). Computer Vision (Th4)			GE-3 A/B	NCC	Health & Wellness (Th2)	Summer Internship in between 4th and 5th Sem. During session break (6-8 weeks) (Credit-4). Field Visit/Industrial Project/ Final Year Research Project-I (Credit-2, for 3 years programmes)	28 (Excluding NCC)
		6th	1). Cryptography and Network Security (Th 4) 2). Web Technology (Th3+P1) 3). Advance Data Science (Th3+P1)	1). Big Data (Th 4)/ 2). Compiler Design (Th 4)		SEC 3- MOOCs/NPTEL		NCC		Field Visit/Industrial Project/ Final Year Research Project-II (Credit-4, for 3 years programmes)	22 (Excluding NCC)

Note: For 04 years undergraduate programmes, research projects will be of 6 credits each in last 02 semesters.
*General Elective: Certificate will be provided to the students opted for NCC apart from degree.
** One SEC must be E&I and IPR (Can be through NPTEL or IPR can be from TIFAC, DST)
To be implemented from 2027-2028

M.C. A		7 th	C13- C14-	DSE 7- A/B+DSE-8	AECC 5-			NCC	VAC-1		23 (Excluding NCC)
		8 th	C15- C16-	DSE-9 A/B +DSE-10	AECC 6- Research & Publication Ethics	SEC 4-MOOCs (E&I/IPR)	GE -4 A/B	NCC	VAC-2	Seminar/Industrial Training/ Research (Credits-4)	26 (Excluding NCC)
		9 th	C17- C18-	DSE-11 A/B DSE-12			GE-4 A/B	NCC	VAC-3	Seminar/Industrial Training/ Research (Credits-4)	28 (Excluding NCC)
		10 th	C-19 C-20			SEC 5- MOOCs		NCC		Research Project (Credits -16)	20 (Excluding NCC)

Format-2

IIMTU-NEP Implementation: BSC (CS-DS) **Format-2**

Program	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester	Prerequisite	Elective (For other faculty)
CERTIFICATE COURSE	FIRSTYEAR(56 Cr.)	SEMESTER -I (26 Cr.)	i) C1	3	3	40	'C' Programming	5		
			C1 (lab)	2	2	20	'C' Programming lab			
			C2	4	4	40	Probability and Statistics			
			C3	3	3	40	Basics of Computers and Recent Trends	5		
			C3 (lab)	2	2	20	Basics of Computers and Recent Trends lab			
			ii) DSE1	4	4	40	ERP	5		
							M-Commerce			
			iii) AECC 1	3	3	40	English Communication	5		
			iv) SEC1	2	2	30	Office Automation Tools	5		
				2	2	20	Office Automation Tools Lab	5		
			v) VAC 1	2	2	30	Indian Ethos and Modern Management	5		
		SEMESTER – II (30 Cr.)	i)	3	3	40	Advance C Programming	5		
			ii) C4	2	2	20	Advance C Programming lab			
			C4 (lab)	4	4	40	Mathematics -II	5		
			C5	3	3	40	Linux Administration with Scripting			
			C6	2	2	20	Linux Administration with Scripting lab	5		
			C6 (lab)	4	4	40	Digital Electronics & Computer System	5		
			ii) DSE 2				Architecture			
							Information System			
			iii) AECC 2	4	4	40	Environment & Ecology	5		
			iv) SEC 2	2	2	20	Environment & Ecology Lab			
				2	2	30	IPR/E&I	5		

Note: Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.

Programme Outcome:	**Programme Specific Outcome:**
PO_1 PO_2 PO_3 ***Program Outcome and Program Specific Outcome – See Annexure – 1** **@List is attached in Annexure – 2**	PSO_1 PSO_2 PSO_3 PSO_4

Programme	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester)	Prerequisite	Elective (For other faculty)
DIPLOMA COURSE	SECOND YEAR (49 Cr.)	SEMESTER –III (24 Cr.)	i) C7	3	4	45	Data Structure and Algorithm using C	5		
			C7 (lab)	1	4	10	Data Structure and Algorithm using C lab			
			C8	4	4	40	Operating System	5		
			C9	3	4	40	Machine Learning	5		
			C9 (lab)	1	4	10	Machine Learning Lab			
			ii) DSE 3	4	4	40	Block Chain Data Mining and Data Warehousing	5		
			iii) AECC 3	3	4	40	Human Values and Professional Ethics	5		
			iv) SEC 3	1	4	40	Basics of SQL	5		
				1	4	40	Basics of SQL Lab			
			v) VAC 2	3	4	40	Cyber Security	5		
			Note: Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.							
		SEMESTER –IV (21 Cr.)	i) C10	3	4	45	OOPs using Java	5		
			C10 (lab)	1	4	10	OOPs using Java lab			
			C11	4	4	40	Software Engineering	5		
			C12	3	4	40	Artificial Intelligence	5		
			C12 (lab)	1	4	40	Artificial Intelligence Lab			
			ii) DSE 4	4	4	40	IOT	5		
				3	4	40	Mobile Application Development			
				1	4	40	Mobile Application Development lab			
				3	4	40	Python Programming			
			iii) AECC 4	1	4	40	Python Programming lab			
			iv) SEC 4	3	4	40	Professional Skills	5		
				2	4	40	E&I	5		

				4			Summer internship in between 4th and 5th sem.			

Note: Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.

Programme Outcome:	**Programme Specific Outcome:**
PO_1 PO_2 PO_3 ***Program Outcome and Program Specific Outcome – See Annexure – 1** **@List is attached in Annexure – 2**	PSO_1 PSO_2 PSO_3 PSO_4

Programme	Year	Semester (15 weeks)	Paper	Credit	Periods per Week	Periods (Hours) per Semester	Paper Title	Unit (Periods per semester)	Prerequisite	Elective (For other faculty)
DEGREE COURSE	THIRD YEAR (42 Cr.)	SEMESTER –V (18 Cr.)	i) C13	4	4	45	Theory of Computation	5		
			C14	3	4	40	Computer Networks	5		
			C14	1	4	10	Computer Networks Lab			
			C15	3	4	40	Data Science	5		
			C15	1	4	40	Data Science Lab			
			ii) DSE 5	4	4	40	Natural Language Processing Computer Vision	5		
			iii) VAC 3	2	4	40	Health and Wellness	5		
				4			Industrial Training/Survey/Research Project			
		SEMESTER – VI 16 Cr.)	i) C16	3	4	45	Web Technology	5		
			C16	1	4	10	Web Technology Lab			
			C17	4	4	40	Cryptography and Network Security	5		
			C18	3	4	40	Advance Data Science	5		
			C18	1	4	10	Advance Data Science Lab			
			ii) DSE 6	4	4	40	Big Data Compiler Design	5		
				4			Industrial Training/Survey/Research Project			

Note: Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course. MOOCs of 2Cr. should be earned before ending of first year.

Annexure -1

Programme Outcome:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.

Programme Specific Outcome:

PSO1: The graduates are proficient in fundamental principles and methods of Computer Science, Mathematical and Scientific reasoning and are able to:

- Apply fundamental concepts of integration, differentiation, vector calculus, probability & statistics, and discrete mathematics.
- Design, create & evaluate algorithms appropriate to specific problems.

PSO2: The graduates have understanding for:

- Demonstrate capability for computers, computer network and server environments and there troubleshooting.
- Capacity to handle cloud computing environment and solutions.
- Well defined knowledge for solving problems of security and threats in information knowledge domain.

Format-3

Format-3

IIMTU-NEPIMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Probability & Statistics**
Course Code: 24BCS-DS102	**Title: Probability & Statistics**
Course Objectives:	
CO1: Understand the concepts of curve and central tendency. CO2: Understand the basic concepts of probability and events. CO3: Formulate theorems about the concept of probability. CO4: Solve the problem on mean and variance. CO5: To classify the data based on different parameters.	
Nature of Paper: Core	
Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)	
L: 4 T:0 P: 0 (In Hours/Week) Theory-1Hr.=1Credit Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)	

Unit	Contents	No. of Lectures Allotted
I	**Basics of Data Science:** Defining Objective of study, Population(universe), collection of data-census, method of sampling, Tools of collecting data-questionnaire, telephonic conversation, emails, sms, online surveys, Classification of Data-based on various parameters Age, income, gender, education etc, Tabulation of Data-Forming the tables for further Analysis. **Central Tendency:-**Basics of Normal Curve, Average and their needs-Mean (AM, GM, HM), Median, Mode, Why always AM is used as Average generally, Locational Averages-Quartiles, Deciles, Percentiles.	10
II	**To discuss parameters of Normal tendency of Data: Skewness & Kurtosis:-**Defining the Moments and Moment Generating Functions, Moments about Actual Mean or Arbitrary Origin, defining SKEWNESS as Horizontal distortion of Data-Karl. Pearson's coefficient of Skewness, Bowlay's coefficient of Skewness, Skewness by methods of Moments, Defining KURTOSIS as Vertical distortion of Data-Playkurtic, Mesokurtic, Leptokurtic curves, Understanding the Normal Curve through Skewness & Kurtosis.	10
III	**Theory of Probability-1** Basics of Probability-Simple events, Sure events, impossible events, Compound Events, Equally likely events, Exhaustive Events, Understanding the Sample Space, empirical definition of probability, Defining the logical connectives OR, IF THEN & AND in probability, Understanding OR-Addition Theorem of Probability-Mutually & Non-Mutually Exclusive events.	10

IV	**Discrete Theoretical Distributions:** Binomial Theoretical Distributions and its Parameters, Poissson Theoretical Distributions and its Parameters, Applications of theoretical distribution to create expected frequencies. **Continuous Theoretical Distributions:-** Defining Normal (or Gaussian) Distribution-Understanding its characteristics mean & variance, Defining The standard normal Distribution-Understanding Area under Normal Curve, Understanding The Normalization of Data.	10
V	**Introduction of Linear Algebra(in Brief):-**Vectors & Scalars- Products, cosine law, Orthogonal vectors, linear combination, linear independence of vectors, Matrices- addition, Product, transpose, determinant, Identify matrix, Invertible matrix, Inverse, rank of Matrix, Trace, Spur, Popular Types of Matrices-Symmetric, Diagonal, Orthogonal, Orthonormal, Eigen values & Eigen Vectors. **Introduction of Topology (In Brief):-** Introduction of Metric spaces (Metric distances)- Various types of Metric.	10

Text Book:

1. "Fifty Challenging Problems in Probability with Solutions": By Frederick Mosteller.
2. "An Introduction to Probability Theory and Its Applications": By William Feller.

Reference Book:

1. "Probability Statistics and Queueing Theory" by P Kandasamy

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the discrete and continuous distributions.
CO2: Able to understand the basic rules and theorems in probability.
CO3: Able to solve the problems on mean and variance.
CO4: Able to understand the key concepts of probability.
CO5: Able to define various types of metric.

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Basics of Computers and Recent Trends**
Course Code: 24BCS-DS103	**Title: Basics of Computers and Recent Trends**

Course Objectives:
CO1: To develop a foundational understanding of computer systems.
CO2: To provide students with a foundational understanding of the Internet, its components.
CO3: To introduce students to the fundamental concepts, and classifications of operating systems.
CO4: To provide students with a basic understanding of data communication principles.
CO5: To familiarize students with emerging technologies such as cloud computing, mobile computing, virtual and augmented reality, and the Internet of Things.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Basics of Computer:** Introduction to computer system, uses, types. Overview of Data Representation - Number systems and Coding Schemes (ASCII and UNICODE). Overview of Human Computer Interface - Relationship between Hardware and Software, Types of software, utility programs. Role of Computers in Business, Manufacturing, Media, Defense Services and Education.	8
II	**Overview of Internet and Its Uses:** Introduction to Internet. Role and importance of Internet, Overview of Web Server and Web clients like web browser or web applications, world wide web, Search Engines, E-mail, e-Library, e-business.	8
III	**Overview of Operating system:** Definition, Functions, Types, Classification, Elements of command based and CUI and GUI based operating system (DOS and WINDOWS)	8
IV	**Overview of Computer Network:** Introduction to Data communication, Modes of Communication (Simplex, Half-Duplex and Full- Duplex) Introduction to Computer Networks, Types of Computer networks (LAN, WAN and MAN), , Network Topologies.	8
V	**Recent Trends Technologies:** Cloud Computing - Meaning, Features, & Service models (IaaS, PaaS, SaaS), Advantages and Disadvantages, Mobile Computing - Meaning, Business Applications of Mobile computing, Virtual reality & Augmented Reality - Meaning and applications, Internet of Things	8

	(IoT) – Definition, Sensors, Applications of IoT, Industrial IoT.	

Text Books:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
2. Norton P., "Introduction to Computers", McGraw Hill Education.
3. Introduction to Information Technology by ITL Education Solutions Limited, second edition.

Reference

1. Balagurusamy E., "Fundamentals of Computers", McGraw Hill.
2. Thareja R., "Fundamentals of Computers", Oxford University Press.
3. Information Technology The breaking wave by Dennis Curtin Tata Mc Graw-hill edition.
4. Introduction to Information Technology by P. Aksoy and L. De Nardis, Cengage Learning, 2006.

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Students will be able to **identify and explain** the different types of computer systems.
CO2: Students will be able to **describe** key elements of Internet infrastructure
CO3: Students will be able to **compare** CUI and GUI operating systems.
CO4: Students will be able to **describe** various modes of communication and types of computer networks.
CO5: **Analyze** the characteristics and applications of cloud service models, mobile computing.

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: ERP**
Course Code- 24BCS-DS104	**Title: ERP**

Course Objectives:

CO1: Understand what an enterprise is, how it can be managed with ERP?
CO2: To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
CO3: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 Theory 1 Hr = 1 credit

Units	Contents	No. of Lectures Allotted
I	What are Enterprise, Enterprise Resource Planning, Evolution and Structure of ERP, Basic ERP Concepts, Benefits and Risks of ERP**?**	**8**
II	ERP Implementation: Objectives, Introduction, ERP Implementation Methodology, Evaluation Of The Various ERP Packages.	**8**
III	ERP Business: Selection Criteria For ERP Packages, Implementation of ERP Packages	**8**
IV	ERP Market Place: Objectives, Introduction, Reasons for the Growth of The ERP Market.	**8**
V	**ERP & E-COMMERCE:** Understanding E-Commerce, Distinct Categories Of E-Commerce, Categories Of E-Commerce, and Relevance Of ERP With E-Commerce.	**8**

Text Books

1. Alexis Leon, "ERP Demystified", Tata McGraw–Hill Education.
2. Vinod Kumar Garg, N K Venkitakrishnan, "*Enterprise Resource Planning–Concepts and Practice",* PHI.

Referential Books

1. Joseph A. Brady, Ellen F. Monk, Bret J. Wagner, "Concepts in Enterprise Resource Planning", Course Technology Cengage Learning.
2. Rahul V. Altekar, *"Enterprise wide Resource Planning"*, Tata McGraw Hill.

Evaluation / Assessment Methodology	
	Max. Marks- 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	15 - - 10 75
Total	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Able to Understand what an enterprise is, how it can be managed with ERP? CO2: Able to provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology. CO3: Able to focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach. CO4: Able to train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth. CO5: Able to aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.	

Format -3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: M-Commerce**
Course Code: 24BCS-DS105	**Title: M-Commerce**

Course Objectives:
CO1: Understand what M-Commerce is, how it can be managed, relation with E-Commerce?
CO2: To provide a contemporary and forward-looking on theory and practice of M- Commerce.
CO3: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO4: To train the students to develop the basic understanding of how M- Commerce, enriches the business organizations in achieving a multidimensional growth.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L:4
T:0
P:0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Units	Contents	No. of Lectures Allotted
I	**Introduction to Mobile commerce:** Definition, Scope of Mobile Commerce, Benefits and Limitations of M-Commerce, M-Commerce Framework, M-Commerce business Models, E-Commerce Vs M-Commerce, Impact of M-Commerce.	8
II	**Mobile commerce technology:** Types of Mobile Clients (Mobile Phones, PDAs, Laptop Computers, Vehicle-mounted Devices, Hybrid Devices etc.). Device Limitations: Considerations for user Interface and Application Design, Device Location Technology: GPS, Triangulation. Mobile Client Software: Mobile Device Operating Systems, Micro browsers, Mobile Device Communications Protocols: WAP, I-Mode, Mobile Device Page Description Languages, Mobile Device Application Software.	8
III	**Wireless communications of technology** Wireless Wide Area Network (WWAN) Technology: Cellular Systems, 2G (CDMA, TDMA, GSM), 2.5G (GPRS, EDGE), 3G (WCDMA/UMTS, CDMA2000), 4G, 5G. Wireless Local, Area Network (WLAN) Technology (Wi-Fi), Wireless Metropolitan Area Network (WMAN) Technology (WiMAX), Wireless Personal Area Network (WPAN) Technology (Bluetooth).	8

IV	**M-Commerce applications:** Mobile Financial Services, Mobile Advertising, Mobile Payment, Mobile Ticketing, Mobile Product Location and Shopping, Mobile Business Services, Mobile Auction, Mobile Entertainment, Mobile Office, Mobile Distance Education.	**8**
V	**BUSINESS-TO-BUSINESS MOBILE E-COMMERCE** Enterprise Enablement, Email and Messaging, Field Force Automation (Insurance, Real Estate, Maintenance, Healthcare), Field Sales Support (Content Access, Inventory), Asset Tracking and Maintenance/Management, Remote IT Support, Customer Retention (B2C Services, Financial, Special Deals), Warehouse. **Future of M- Commerce:** Future challenges, security, scalability.	**8**

Text Books

1. Advanced E-Commerce and Mobile Commerce, Divakara Reddy N., Suman M., Himalaya Publication house Pvt. Ltd., ISBN 978-93-5202-139-0, New Delhi.
2. MOBILE COMMERCE, Bandyopadhyay, Karabi, PHI Learning Pvt. Ltd., Delhi, Edition II

Referential Books

1. Brian E. Mennecke, Troy J. Strader, "Mobile Commerce: Technology, Theory and Applications", Idea Group Inc., IRM press, 2003.
2. P. J. Louis, "M – Commerce Crash Course", McGraw – Hill Companies February 2001.
3. Paul May, "Mobile Commerce: Opportunities, Applications, and Technologies of Wireless Business" Cambridge University Press March 200l.

Evaluation / Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to Understand what M-Commerce is, how it can be managed, relation with E-Commerce?

CO2: Able to provide a contemporary and forward-looking on theory and practice of M- Commerce.

CO3: Able to focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.

CO4: Able to train the students to develop the basic understanding of how M- Commerce, enriches the business organizations in achieving a multidimensional growth.

CO5: Able to at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 2 **Theory: 2** **Practical: 0**	**Course: Office Automation Tools**
Course Code: 24BCS-DS106	**Title: Office Automation Tools**

Course Objectives:
CO1: To understand the basic knowledge of computer about its generations and windows.
CO2: To apply the changing background of windows desktop, creating shortcut how to display toolbar.
CO3: To understand student will get the basic knowledge to create a file in MS word and format the files.
CO4: To understand the student will knowledge enter data in Excel, arrange data format data, how to use various functions sort information.
CO5: To understand create different types of Charts and Tables.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 40% Marks / 2 Credits (Internal + ESE)

L: 2
T: 0
P: 0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to File Formats with Types and Extension:** Text file, PDF file, JPG file, GIF file, ZIP file. **Introduction to Windows:** Introduction to Windows, Start Menu, Working with Programs, Customizing with Windows, Accessories of Windows, Introduction of software, Types of software.	4
II	**Introduction to Ms-WordWorking with Documents** -Opening & Saving files, editing text documents, Inserting, Deleting, Cut, Copy, Paste, Undo, Redo, Find, Search, Replace, Formatting page & setting Margins. **Formatting Documents -** Setting Font styles, Font selection- style, size, color etc, Type face - Bold, Italic, Underline. **Setting Page style -** Formatting Page, Page tab, Margins, Layout settings, Border& Shading, Columns, Header & footer, Setting Footnotes. **Tools –** Spell Checks, Mail merge, Templates. **Creating Tables**- Table settings, Cell, Insert to cell, Borders, Alignments, Insertion, deletion, Merging, Chart in MS word, Table in MS word.	4
III	**Introduction to Microsoft Excel:** Spread Sheet & its Applications, Opening Spreadsheet, Menus - main menu, Formula Editing, Formatting, Toolbars, Using Icons, Shortcuts. **Working with Spreadsheets-** opening, saving files, setting Margins, Converting files to different formats (importing, exporting, sending files to	4

	others) **Entering & Deleting Data-** Entering data, Cut, Copy, Paste, Undo, Redo, Highlighting values, Find, Search & replace, Inserting Data, Insert Cells, Column, rows & sheets, Symbols. **Formulas and Functions in Microsoft Excel:** Introduction, calculating with the help of Formulas and Functions (SUM, AVERAGE, COUNT, MAX, MIN, IF), Row, Columns and Cells, Table Format, Sorting.	
IV	**Basic of Microsoft Power Point:** Introduction to presentation – Opening new presentation, Different presentation templates, Setting backgrounds, Selecting presentation layouts. **Creating a presentation** - Setting Presentation style, Adding text to the Presentation. **Formatting a Presentation -** Adding style, Color, Arranging objects, Adding Header & Footer, Slide Background, Slide layout.	4
V	**Microsoft Access:** Introduction of M.S Access, planning a database, StartingAccess, Create a new database.	4

Text Books:

1. E .Balagurusawy, V.Rajaraman "*Office Automation Tool"*.McGraw-Hill.
2. Kevin Pitch*"MS-Office Windows*".Dinesh Maidasani MS Office.

Reference

1. Priti Sinha, Pradeep K. Sinha" *Office Automation Tool*".6th Edition

Evaluation/Assessment Methodology

	Max. Marks- 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand will getthe basicknowledge of computer about its generations and types Windows.

CO2: Able to understand Changing background of windows desktop, creating shortcut how to display toolbar.

CO3: Able to understand Student will get the basic knowledge create a file in word and format the files.

CO4: Able to understand the student will the basic knowledge enter data in excel, arrange data format data, how to use various functions sort information.

CO5:Able to understand create different types of chart and Tables.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Feature Engineering**
Course Code: 24BCS-DS106-3	**Title: Feature Engineering**
Course Objectives:	
CO1: Extract useful features from data and convert them to features. CO2: Learn how to deal with infrequent, rare, and unseen categories. CO3: Learn to transform categorical variables into no. while capturing meaningful information. CO4: Learn to convert numerical variables into discrete ones. CO5: Learn techniques to pre-process data and build more powerful machine learning models.	
Nature of Paper: DSE	
Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)	
L: 4 T: 0 P: 0 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4 Hrs./Week= 4 Credits)	

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Feature Engineering, Importance of feature engineering, Evaluation of machine learning algorithm and Feature engineering procedures. Feature Understanding: Feature Improvement-cleaning datasets, Feature Selection-removing bad attributes, Feature construction, Feature Transformation, Feature learning	8
II	**Data Pre-processing and Missing Values:** Handling missing values, identification, imputation techniques (mean, median, regression-based), and impact on models. Basics of Feature Representation: Scalars and Vectors, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling).	8
III	**Encoding and Transformation Techniques Handling categorical variables:** one-hot encoding, label encoding, and target encoding, Handling text data: bag-of-words representation, TF-IDF encoding, and word embeddings. Numerical transformations: handling skewed distributions, logarithmic transformations, and scaling techniques. Binning and discretization of continuous variables.	8
IV	**Feature Selection:** Importance of Feature Selection in Machine Learning, Goals of Feature Selection, Classes of Feature Selection Methodologies. Effect of Irrelevant Feature, Univariate feature selection: statistical tests and feature importance, Recursive Feature Elimination, Stepwise Selection.	8
V	**Feature Transformations:** Intuition, Derivation, Linear Projection, Variance	8

	and Empirical Variance - Vector Formulation, General Solution of the Principal Components, Transforming Features, Implementing PCA, PCA in Action, Considerations and Limitations of PCA, Use Cases	

Text Books:

1. Max Kuhn , Kjell Johnson, "Feature Engineering and Selection: A Practical Approach for Predictive Models" 1st Edition, Chapman & Hall/CRC Data Science Series, ISBN 13- 978- 1-138-07922-9.
2. Sinan Ozdemir, Divya Susarla, "Feature Engineering Made Easy", Packt Publishing, ISBN 978-1-78728-760-0

Reference

1. Alice Zheng & Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for data scientist", Oreilly Publications

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Create new features from existing ones.
CO2: Impute missing data and encode categorical variables.
CO3: Transform numerical variables and change their distribution.
CO4: Perform discretization, remove outliers, and extract features from date & time.
CO5: Reduce dimensionality of data using PCA.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)(DS)**	**Year : I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Basics of Data Analytics using Spread Sheet**
Course Code: 24BCS-CS107-4	**Title: Basics of Data Analytics using Spread Sheet**

Course Objectives:

CO1: To familiarize students with the fundamental concepts of data analytics, types of data, applications, and basic use of spreadsheet tools for data handling and analysis.
CO2: To enable students to acquire foundational skills in Microsoft Excel for entering, organizing, and managing worksheet data, performing basic operations, and applying simple formulas and functions effectively.
CO3: To equip students with the skills to create and use formulas, apply various functions, generate and format charts, and perform basic data analysis using spreadsheet tools.
CO4: To develop students' ability to visualize and analyze data by creating and customizing charts, and applying essential spreadsheet data analysis tools.
CO5: To enhance students' proficiency in advanced Excel functions for conditional analysis, data visualization, and automation using macros.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week= 4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Data Analytics:** Understanding data and its types (Structured, Unstructured, semi structured), What is Data Analytics, Type of Data Analytics, Application of data Analytics, Introduction to spread sheet tools (Excel, Google sheets)	8
II	**Introduction to Excel Basics**: Entering and editing worksheet data, Performing basic worksheet operations, Use of simple arithmetic operations, Working with excel ranges and tables, Working with Formulas and Functions, Selecting Columns & Rows, Changing Column Width & Row Height, Auto fitting Columns & Rows, Hiding/Un hiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell.	8
III	**Creating Formulas:** Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, Lower, Using AutoSum, using text functions to manipulate text, using date and time functions, Using formulas for financial analysis.	8
IV	**Spreadsheet Charts:** Creating Charts, Different types of charts, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend,	8

	Showing and Hiding the Data Table **Data Analysis** Sorting, Filter, Text to Column, Data Validation	
V	**Advanced Excel Functions for Data Analysis** Using formulas for Conditional Analysis, Use the IF function to evaluate a condition and return values based on the result, Apply the AND and OR functions to evaluate multiple conditions, perform conditional calculations (SUMIF, COUNTIF, AVERAGEIF), Data Visualization with Excel Demonstration of creation of a bar chart representing sales data for different months. Customize the appearance of a chart, including colors, fonts, titles, legends and axis labels, Making Macros Recording Macros, Running Macros, Deleting Macros	8

Text Books:

1. Excel 2019 bible, Alexander, M., Kusleika, R., & Walkenbach, J. (2018), John Wiley & Sons.
2. Excel data analysis for dummies, Nelson, S. L., & Nelson, E. C. (2014), John Wiley & Sons.
3. Data Analysis with Microsoft Excel, Berk, K. N., & Carey, P. (1998), Pacific Grove, CA: Duxbury Press.

Reference

1. Excel Data Analysis Modeling and Simulation., Hector, G. (2019), Spinger.
2. Microsoft Excel data analysis and business modelling, Winston, W. (2016), Microsoft press.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course:

Course Learning Outcomes:

CO1: By the end of the course, students will be able to identify different types of data, explain data analytics concepts, recognize its applications, and perform basic data operations

CO2: Students will be able to create and edit worksheets, manage rows, columns, and ranges, apply basic arithmetic and functions, and format spreadsheet data for efficient presentation and analysis.

CO3: Students will be able to apply formulas and functions for calculations and text manipulation, create and customize charts, and use spreadsheet features like sorting, filtering, and data validation for effective data analysis

CO4: By the end of the course, students will be able to design and format various chart types, modify chart elements, and perform data analysis using sorting, filtering, text-to-column, and data validation features.

CO5: By the end of the course, students will be able to perform conditional calculations using advanced functions, create and customize charts for data presentation, and automate repetitive tasks through recording and managing macros.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester; I

Program: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Office Automation Tools Lab**
Course Code: 24BCS-DS108P	**Title: Office Automation Tools Lab**

Course Objectives:
CO1: To understand Office tools course would enable the students in crafting professional word documents, excel spread sheets, power point presentations using the Microsoft suite of office tools.
CO2: To understand Familiarize the students in preparation of documents and presentations with office automation tools.
CO3: To understand Student will get the basic knowledge to create a file in MS word and format the files.
CO4: To understand Create different types of Charts and Tables.
CO5: To understand Changing background of windows desktop, creating shortcut how to display toolbar.

Nature of Paper: SEC

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit (2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Understanding the desktop, taskbar, and start menu. Navigating files and folders, understanding different views, and managing files. How to create, rename, and organize folders. How to install new programs and remove unwanted ones.	1
2.	Create a Resume and other document using the table and shapes, Font color, Font size Text highlight color, Page number, Margins, Watermark, Page border, Page color, Align text.	1
3.	Create a flowchart using, a. Proper shapes like ellipse, arrows, rectangle, and parallelogram. b. Use grouping to group all the parts of the flowchart into one single object.	1
4.	Create a table using table menu with, a. At least 5 columns and 10 rows. b. Merge the first row into one cell. c. Merge the second row into one cell, then split the second row into three cells. d. Use proper table border and color	1
5.	Create a table using two columns, a. The left column contains all the short-cut keys and right side column contains the function of the short-cut keys. b. Insert a left column using layout option. Name the heading as Serial No.	1

6.	Opening Microsoft Excel Cells Filling in cells Selecting, Copying, Cutting, and Pasting Pasting Formulas Inserting or deleting row or columns Changing Column Width Formatting cells Changing fonts Saving an excel file	2
7.	Create a table "Student result" with following conditions. a. The heading must contain, Sl. No., Name, Mark1, Mark2, Mark3, Total, average and result with manual entry. b. Use formulas for total and average. c. Find the name of the students who has secured the highest and lowest marks. d. Round the average to the nearest highest integer and lowest integer (use ceiling and floor function respectively).	2
8.	Create a Student Table in MS-Access with the following features: a. Roll Number b. Student Name c. Class d. Marks in Subject 1, Subject 2, Subject 3 e. Total f. Average g. Result	2
9.	Create a Personal Information table in MS-Access with the following fields: a. First Name b. Middle Name c. Last Name d. Nationality e. Gender f. Temporary Address g. Permanent Address. Generate a Form and Report.	2
10.	Create a minimum of 10 slides with a slide theme appropriate for the topic.	2

Reference / Text Books:

- Office Automation Tools Lab/MS. Word:" by M. L. Humphrey".
- Office Automation Tools Lab/MS power point/MS. Access:" by MOIRA Stephen,. Kevin Pitch.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	-
2) Presentations /Seminar	-
3) Assignments	-
4) Practical/Research Project Report Seminar On Research Project Report	25
5) ESE	25
Total:	**50**

Program Learning Outcomes:

CO1: Students will be able to develop to create the folder, files based on office automation tools.
CO2: Students will be able to understand create the resume and all function used in MS word.
CO3: Students will be able to understand create the Mark sheet and all function used in MS excel.
CO4: Students will be able to understand Create a Student Table in MS-Access with the following features.
CO5: Students will be able to understand Create a minimum of 10 slides with a slide theme appropriate for the topic.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Basics of Computers and Recent Trends Lab**
Course Code: BCS-DS109P	**Title: Basics of Computers and Recent Trends Lab**

Course Objectives:
CO1: To introduce the fundamental components of computer hardware, including input, output, processing, and memory devices, and their roles in a computer system.
CO2: To develop practical skills in using operating systems, including file management, executing DOS commands, and managing installed applications.
CO3: To enable students to create and manage online accounts, such as email and e-commerce portals, for communication and digital transactions.
CO4: To explore the hardware elements used in computer networking.
CO5: To examine real-world applications of cloud computing technologies.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1 Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Practical Allotted
1.	Demonstrate the Computer Hardware Components- Input devices (KB, Mouse, Scanner), Output Devices (Monitor, Printers, Speaker), Process Devices (Motherboard, Microprocessor) and Memory Devices (RAM, ROM, HDD, DVD)	1
2.	Create an E-mail Id account in various mail portal like Gmail, yahoo etc.	1
3.	Create an account in various E-business portal like Amazon, Flipkart etc.	1
4.	Search the e-library portal through search engine and create an account to access the various services of library.	1
5.	Practices the various DOS internal and external commands.	2
6.	Explore the entire desktop Explore the file manager. Create, rename, and organize files and folders. To install and uninstall programs.	2
7.	Demonstrate the Computer Network Hardware Components- Various types of network cables (Coaxial, Twisted pair), HUB, Switches (16 and 32 Port), Connectors (T-connector, USB connector)	2
8.	Explore the use of cloud computing in various cloud based applications like Data Storage, AWS, Social Media etc.	2

Reference / Text Books:

1. Balagurusamy E., " Fundamentals of Computers", McGraw Hill
2. Thareja R., "Fundamentals of Computers", Oxford University Press.
3. Andrew ,S. Tanenbaum, Fifth Edition
4. An Essential Guide to windows 10.
5. DOS – The Complete Reference, Tata-McGraw Hill, 1997 Edition-4th.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	-
2) Presentations /Seminar	25
3)Assignments	-
4) Practical File, Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

CO1: Identify and describe the purpose and functions of various computer hardware components, including input, output, processing, and storage devices.

CO2: Demonstrate the ability to perform basic operating system functions, such as navigating the desktop, managing files and folders, and using internal and external DOS commands.

CO3: Create and manage user accounts on email services (e.g., Gmail, Yahoo) and e-commerce platforms (e.g., Amazon, Flipkart), showing competence in digital identity management.

CO4: Explain the function and setup of common network hardware, including different types of cables, switches, and connectors, used in networking environments.

CO5: Analyze how cloud computing is applied in services like online data storage, AWS infrastructure, and social media platforms, and describe its benefits and limitations.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Problem solving techniques using 'C' Language**
Course Code: 25BCS-DS101	**Title: Problem solving techniques using 'C' Language**

Course Objectives:
CO1: Explain the needs of programming language.
CO2: Learn Conditional and Iterative Control Statements in 'C' language.
CO3: Students will be able to learn the basics of functions in 'C' language.
CO4: Students will be familiar with uses of an array.
CO5: Students will be familiar with File handling programs to perform read write operations and how to use functions in 'C' language.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to 'C' Language:** History, C Character Set, Tokens, Keywords, Constants, Identifiers, Variables, Data Types, Comments, Structures of 'C' Program. Assignment Operators, Expressions, Statements, Arithmetic Expressions. **Storage Classes:** Automatic, External, Static & Register.	8
II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, go to Statement, Loops (for, while, do-while) in C, Nested Loops, break and continue Statements.	8
III	**Functions:** Advantages of Functions, declaring a Function, defining a Function, calling a Function, Argument Passing – Call by Value, Call by Reference, Types of Functions, Recursion.	8
IV	**Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data from Array, Multi-Dimensional Arrays.	8
V	**File Handling:** Introduction, File Types- Text, Binary, The File Pointer, Opening a File, Closing a File, Reading and Writing a File, File Handling Functions: fgetc(), fputc(), fputs(), fgets(), fprintf(), fscanf(), fwrite(), fread(), fseek().	8

Text Books:
1. Stephen W. Sagman & Gail Taylor,"*MS-Office 2000For Windows*", Peachpit Press.
2. Balaguruswamy, "*Programming in ANSI C",* Tata Mc.Graw-Hill education.

3. Yashwant Kanetkar, *"Let us C",* BPB Publications	
Reference: 1. V. Rajaraman, "*Fundamental of Computers*", Prentice-Hall of India. 2. V Rajaraman, "*Computer Basics and C Programming*", PHI Learning 3. Ashok N. Kamthane, "*Programming in C*", Pearson Education.	
Evaluation/Assessment Methodology	
	Max. Marks- 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	15 - 10 - 75
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes:	
CO1: Understand basic concepts of 'C' programming language. CO2: Familiarize students with Conditional and Iterative Control Statement in 'C' language. CO3: Students will be able to use functions in 'C' language. CO4: Students will be able to solve problems with an Array. CO5: Familiarize students with File Handling in 'C' language.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Program: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: I**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Problem solving techniques using 'C' Language Lab**
Course Code: 25BCS-DS107P	**Title: Problem solving techniques using 'C' Language Lab**

Course Objectives:
CO1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.
CO2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements.
CO3: Students will be familiar with the concept of Arrays.
CO4: Students will be able to develop a Program with Functions Operations.
CO5: Students will be familiar with File handling programs to perform read-write operations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Write a program to display “hello world” in C.	1
2.	Write a program to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd.	1
3.	Write a program to check whether the entered year is a leap year or not (a year is a leap if it is divisible by 4 and divisible by 100 or 400.)	1
4.	Write a program to read a string and check for palindrome without using string-related functions (a string is a palindrome if its half is mirror by itself.	1
5.	Write a program to find the biggest among three numbers.	1
6.	Write a program to print a table of a given number.	1
7.	Write a program to print a factorial of a given number.	1
8.	Program to read two integer and two floating point numbers.	1
9.	Program to accept the marks of 5 subjects and finds the sum and percentage marks obtained by the student.	1
10.	Program to calculate the simple interest and compound interest (The Principal, Amount, Rate of Interest and Time are entered through keyboard).	1
11.	Program to calculate the area and circumference of a circle.	1

12.	Program that swaps values of two variables using a third variable.	1
13.	Program that swaps the values of two variables without using a 3rd variable.	1
14.	Program to calculate and print the area of triangle, where the three sides of the triangle is given as input.	1
15.	Program that checks whether the two numbers entered by the user are equal or not.	1
16.	Program to find whether a given number is even or odd.	1
17.	Write a Program to read two numbers and an operator (+, -, *, /) which performs the specified operation and display the result.	1
18.	Program to display the first N numbers.	1
19.	Program to print the sum of all numbers up to a given number.	1
20.	Program to print sum of even and odd numbers from 1 to N numbers.	1
21.	**Program** to demonstrate the use of **macros** using the #define preprocessor directive.	1
22.	Program that simply takes elements of the array from the user and finds the sum of these elements.	1
23.	Program to find the minimum and maximum element of the array.	1
24.	Write a C program that asks the user for their name and greets them with a welcome message	1
25.	Write a program to copy the content of one file to another file.	1

Reference / Text Books:

- The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie.
- C Programming: A Modern Approach" by K. N. King.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

PO1: Students can develop programs based on fundamental concepts of programming in C.
PO2: Students can solve problems based on Conditional and Iterative Control Statements.
PO3: Students can learn Complete Programming Concepts of Arrays.
PO4: Students can learn conceptual programming with Functions.
PO5: Students can perform File handling programs with read and write concepts

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mathematics -II**
Course Code: 24BCS-DS202	**Title: Mathematics -II**

Course Objectives:

1. Learning different methods to solve various types of differential equations.
2. Introducing series solutions such as power series methods for solving differential equations.
3. Familiarizing with Laplace transforms and their applications in solving the differential equations.
4. Learning to compute coefficients of Fourier series using integration techniques.
5. Understand the fundamental concepts of partial differential equations and their applications in different fields of science.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit (4 Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
1	**Differential Equations:** Linear differential equations of nth order with constant coefficients, Complementary function and Particular integral, Simultaneous linear differential equations, Solution of second order differential equations by changing dependent & independent variables, Normal form, Method of variation of parameters, Applications(without derivation).	8
2	**Series Solution and Special Functions:** Series solution of second order ordinary differential equations with variable coefficient (Frobenius method), Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.	8
3	**Laplace Transform:** Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.	8
4	**Fourier Series**: Euler's Formulae, Functions having arbitrary periods, Periodic functions, Fourier series of period 2π, Change of interval, Even and odd functions, Half range sine and cosine series.	6
5	**Partial Differential Equations:** Solution of first order partial differential equations by Lagrange's method, Solution of second order linear partial differential equations with constant coefficients, Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and	10

	heat conduction equations, Laplace equation in two dimension, Equation of transmission lines.	

Text Books:-

1. H.K. Dass, "*Advanced Engineering Mathematics*", S. Chand & Company.
2. J.P Chauhan, "Mathematics", Krishna Publication.

Reference Books:-

1. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists", Reston Pub. Co.
2. Kenneth H. Rosen, "Discrete Mathematics and Its Applications: With Combinatorics and Graph Theory", Tata McGraw Hill Education

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:-

1. Understand the nature and types of differential equations and to find the solutions with different methods.
2. Find the Series solutions of second order differential equations by different methods.
3. Apply the Laplace transforms and their applications to solve linear differential equations.
4. Understand the representation of periodic functions using Fourier series.
5. Solve various types of PDE's and explore its applications in different branches.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Digital Electronics and Computer System Architecture**
Course Code: 24BCS-DS203	**Title: Digital Electronics and Computer System Architecture**

Course Objectives:
CO1: Understand Fundamental Computer Organization Concepts.
CO2: Analyze Computer Arithmetic and Register Operations.
CO3: Explain CPU Organization and Control Unit Design.
CO4: Evaluate Memory and Input-Output Organization.
CO5: Understand Advanced Processing Concepts.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Basic Functional units of Computers:** Functional units, basic Operational concepts, Flip Flops, Types of Flip Flops Number Systems, Logic Gates and Combinational Circuits, Bus structures. Software, Performance, Multiprocessors, Multicomputer. Data Representation: Signed number representation, fixed and floating-point Representations. Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms. Error detection and correction codes.	8
II	**Register Transfer Language and Micro Operations:** RTL- Registers, Register transfers, Bus and memory transfers. Micro operations: Arithmetic, Logic, and Shift micro-operations, Arithmetic logic shift unit. Basic Computer Organization and Design: Computer Registers, Computer instructions, Instruction cycle. Instruction codes, Timing and Control, Types of Instructions: Memory Reference Instructions, Input – Output and Interrupt.	8
III	**Central Processing Unit organization:** General Register Organization, Stack organization, Instruction formats, addressing modes, Data Transfer and Manipulation, Program Control, CISC and RISC processors Control unit design: Design approaches, Control memory, Address sequencing, micro program example, design of CU. Micro Programmed Control.	8
IV	**Memory Organization:** Semiconductor Memory Technologies, Memory hierarchy, Interleaving, Main Memory-RAM and ROM chips, Address map, Associative memory-Hardware organization. Match logic. Cache	8

	memory-size vs. block size, Mapping Functions-Associate, Direct, Set Associative mapping. Replacement algorithms, write policies. Auxiliary memory Magnetic tapes etc.	
V	**Input –Output Organization:** Peripheral devices, Input-output subsystems, I/O device interface, I/O Processor, I/O transfers–Program controlled, Interrupt driven, and DMA, interrupts, and exceptions. I/O device interfaces – SCII, USB Pipelining and Vector Processing: Basic concepts, Instruction level Parallelism Throughput and Speedup, Pipeline hazards.	8

Text Books:

1. Morris Manno, "Computer System Architecture", Pearson Education.
2. W. Stallings, "Computer Organisation and Architecture", Pearson Education.

Reference:

1. "Computer Architecture and Organization", 3rd Edition by John P. ayes,WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by i. William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry ii. F. Jordan, Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain the basic functional units of a computer, number systems, logic gates, combinational circuits, bus structures, and data representation methods.

CO2: Perform arithmetic operations using various algorithms and demonstrate register transfer language (RTL) and micro-operations in digital systems.

CO3: Describe CPU organization, instruction formats, addressing modes, instruction cycle, and design principles of hardwired and micro programmed control units.

CO4: Analyze memory hierarchy, cache mapping techniques, replacement policies, and different input-output transfer mechanisms including DMA and interrupt-driven I/O.

CO5: Evaluate performance improvement techniques such as pipelining, instruction-level parallelism, multiprocessors, multicomputer, and vector processing systems.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Information System**
Course Code: 24BCS-DS204	**Title: Information System**

Course Objectives:
CO1: Understand the role of information systems in business operations and strategy.
CO2: Analyze and design information systems that meet organizational needs.
CO3: Gain familiarity with various types of information systems, such as ERP, CRM, and SCM.
CO4: Understand the ethical, legal, and social implications of information systems.
CO5: Explore emerging trends in information systems, such as cloud computing, big data, and cybersecurity.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Information Systems:** Definition and components of Information Systems, The role of IS in business and society, Overview of types of Information Systems, Information Systems in Organizations, Organizational structure and IS, IS for competitive advantage, Information systems management roles and structures.	8
II	**Information and communications technologies:** Communications technologies and networks, the internet. Data storage systems, files and databases. **Data and System Development:** Data Management, Database concepts, Data modeling and design, Introduction to SQL **Information Systems Development:** Information systems development approaches; life cycle, prototyping, incremental models. Systems analysis tasks, methodologies, modelling and agile methods. Data modelling. Systems implementation., System development life cycle (SDLC), Agile and Waterfall methodologies, Tools for IS development.	8
III	**Enterprise Systems:** Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Supply Chain Management (SCM) **E-Business and E-Commerce:** E-Business models and strategies, E-Commerce platforms and technologies.	8
IV	**Cloud Computing and Big Data:** Introduction to cloud computing, Big Data technologies and analytics, Impact of cloud and big data on business, Open source software. Social networking.	8

	Cybersecurity and Ethical Issues: Cybersecurity fundamentals, Ethical and legal issues in IS, Data privacy and protection	
V	**Emerging Trends in Information Systems:** Artificial Intelligence and Machine Learning in IS, Blockchain technology, Internet of Things (IoT) and its impact on IS **Information Systems Strategy and Management:** IS strategy alignment with business strategy, IS governance and risk management, Future directions in IS management	8

Text Books:

- Laudon, K.C. and J.P. Laudon. Management Information Systems: Managing the Digital Firm. (New Jersey: Prentice Hall, 2019) sixteenth edition [ISBN 978-0135191798

Reference

- "Information Systems for Business and Beyond" by David T. Bourgeois.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar/Attendance	-
3) Assignments/TA	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcome

CO1: Able to identify role of information systems in business operations and strategy.
CO2: Design information systems that meet organizational needs.
CO3: Gain Knowledge and working with various types of information systems, such as ERP, CRM, and SCM.
CO4: Understand the ethical, legal, and social implications of information systems.
CO5: Able to work in emerging trends in information systems, such as cloud computing, big data, and cybersecurity.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Linux Administration with Scripting**
Course Code: 24BCS-DS205	**Title: Linux Administration with Scripting**

Course Objectives:

CO1: To understand and make effective use of Linux utilities and shell scripting language to solve problems

CO2: To implement in C some standard Linux utilities like mv, cp, ls, etc.

CO3: To Develop the skills the necessary for systems programming including file system programming, process and signal management and interposes communication

CO4: To develop the basic skills required to write network programs using sockets

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Linux History, overview, Principles, Getting started with GNOME and edit text files with gedit, manage files graphically and access remote system with Nautilus, getting help in graphical environment, Installation overview, directory structure, Installation Graphical, Configuring Local Services, date and time, Configuration of printer, Basic commands vi editor, manage users and groups.	10
II	Partition, Swap Creation Ivm, quota management and permanent mouting, Raid, Luks, Basic job control or cron use of helping command scp or ssh, filter command, Understand run levels.	10
III	Package installation with rpm, package installation with yum, use hard links, soft links, archives, Regular Expressions, Pipelines, and I/O Redirection, nfs, cifs and autofs, Ldap, Controlling Access to files, Analyzing and Storing Logs, Managing Processes, Tuning and Maintaining the Kernel, System Recovery Techniques, Enhance User Security, Apache Server.	10
IV	File Security with Gnupg, Route Network Traffic Secure Network Traffic, NTP Server Configuration, Web Server Additional Configuration, Basic SMTP Configuration, Caching-Only DNS Server, FTP, Squid, samba, dhcp, nis, pam, iptables, TCP Wrappers, Bash Scripting and tools, basic Shell Scripting, Graphical tools of Scripting (Zenith and dialogs)	10

Text Books:

1. Nemeth, E., Snyder, G., Hein, T. R., Whaley, B., & Mackin, D. (2017). UNIX and Linux system administration handbook (5th ed.). Pearson.

2. Sobell, M. G. (2017). A practical guide to Linux commands, editors, and shell programming (4th ed.). Pearson.

Reference

1. Soyinka, W. (2016). Linux administration: A beginner's guide (7th ed.). McGraw-Hill Education.
2. Negus, C. (2020). Linux Bible (10th ed.). Wiley.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Nil

Course Learning Outcomes:

CO1: Students will be able to describe Linux history, principles, and graphical interfaces
CO2: Use ssh, scp, filter commands and manage quotas and mounts.
CO3: Configure file access controls, manage logs, and analyze system behavior.
CO4: Configure secure file transfer, DNS, FTP, DHCP, NIS, and mail servers.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Artificial Intelligence**
Course Code: 24BCS-CS205-1	**Title: Artificial Intelligence**

Course Objectives:

CO1: To understand about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: To study the concepts Propositional logics, predicate Logic.
CO3: To understand the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts.
CO4: To understand concepts of Prolog and Implement the Prolog Program.
CO5: To learning concepts of Expert system and Learning.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.= 1 Credit (4 Hrs./Week= 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Introduction to Artificial Intelligence, Task Domains of AI, AI Techniques, Problem formulation, Production systems, Control strategies, Search strategies, Problem characteristics, Production system characteristics, Depth First Search, Breadth First Search, Heuristic Search (Hill Climbing, Best First Search and Problem Reduction).	**8**
II	**Knowledge Representation**: Approaches, Types and Properties of Knowledge, Propositional Logic, Properties of Statements, Equivalence Law, Inference Laws, First Order Predicate Logic, Properties of Wffs, Representation of Facts in First Order Predicate Logic, Conversion to Clausal Forms, Unification and Resolution, No deductive Inference Methods, Rules.	**8**
III	**Structured Knowledge Representation**: Semantic Nets, Partitioned Semantic Net, Semantic Net for Wffs and Predicate Logic, Property Inheritance Algorithm, Frame Structures, Conceptual Dependencies and Scripts	**8**
IV	**Prolog:** Introduction, Facts, Rules, Variables, Operators, Control Structures, Matching, Backtracking, Cuts, Recursion, Lists, Input/output and Streams, Databases, Implementation of Concepts in Prolog.	**8**
V	**Expert System**: Need and Justification of Expert System, Representing and Using Domain Specific Knowledge, Knowledge Acquisition, Expert System Shells, Inference Engine, Learning Procedure and Case Study of MYCIN. **Learning**: Introduction, Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Example-Induction, Explanation Based	**8**

	learning.	

Text Books:

1. Elaine Rich& Kevin Knight, *"Artificial Intelligence"*, Tata McGraw Hill. Dan W. Patterson, *"Introduction to Artificial Intelligence& Expert Systems"*, PHI.
2. S. K. Sarkar, "*Discrete Mathematics*", S. Chand & Co.

Referential Books:

1. Stuart J. Russell &Peter Norvig, "*Artificial Intelligence-A Modern Approach",* Prentice Hall.
2. George F. Luger, "*Artificial Intelligence-Structures and Strategies for Complex Problem Solving*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: mathematics, statistics, and Computer programming.

Course Learning Outcomes:

CO1: Learnt about Artificial Intelligence, AI tasks and AI problem solving technique.
CO2: Learnt study the concepts Propositional logics, predicate Logic
CO3: Learnt the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO4: Learnt concepts of Prolog and Implement the Prolog Program.
CO5: Learnt concepts of Expert system and Learning.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Digital Electronics and Computer System Architecture Lab**
Course Code: 24BCS-DS207P	**Title: Digital Electronics and Computer System Architecture Lab**

Course Objectives:

CO1: Develop a fundamental understanding of digital electronic circuits and systems.
CO2: Provide hands-on experience in designing, building, and testing digital circuits using logic gates, flip-flops, counters, and other basic digital components.
CO3: Familiarize students with different types of digital electronic devices, such as multiplexers, decoders, encoders, and comparators.
CO4: Enhance skills in designing and implementing combinational and sequential circuits to solve practical problems.

Nature of Paper: DSE 2

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=2Credits)

Unit	Contents	No. of Lectures Allotted
I	Implementation of the given Boolean function using logic gates in both sop and pos forms.	2
II	Verification of state tables of RS, JK, T and D flip-flops using NAND & nor gates.	2
III	Implementation and verification of decoder/de-multiplexer and 4 encoder using logic gates.	2
IV	Implementation of 4x1 multiplexer using logic gates.	2
V	Design and verify the 4-bit synchronous counter.	2
VI	Design and verify the 4-bit asynchronous counter.	2
VII	To design and verify operation of half adder and full adder	2
VIII	To design and verify operation of half subtractor.	2

Reference / Text Books:

1. Floyd," Digital Fundamentals", PHI.
2. Morris Mano, "Digital Design", Prentice Hall of India.
3. Tocci.R.J, "Digital Systems-Principles .1 Applications"-Prentice I of India.
4. B. R. Gupta and T.Singhal, "Digital Electronics" 4th Edition, S.K Kataria& sons, India.
5. Fletcher.W.I., "An EngineeringApproach to Digital Design", Prentice Hall of India.
6. Millman&Halkias ,"Integrated Electronics".
7. V.K.PURI, "Digital Electronics", TMH.

Evaluation/Assessment Methodology	
	Max. Marks: 50
1. Class tasks/ Sessional Examination	25
2. Presentations /Seminar	-
3. Assignments	-
4. Practical File /Research Project Report Seminar On Research Project Report	25
5. ESE	-
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Understand the basic principles and concepts of digital electronics, including logic gates, Boolean algebra, and binary number systems.

CO2: Demonstrate proficiency in designing, building, and testing digital circuits using various digital components.

CO3: Analyze and troubleshoot digital circuits using appropriate testing and measurement tools, such as oscilloscopes and logic analyzers.

CO4: Design and implement combinational circuits, such as adders, multiplexers, and encoders, to solve specific problems.

CO5: Design and implement sequential circuits, such as flip-flops, counters, and shift registers, for various applications.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Linux Administration with Scripting Lab**
Course Code: 24BCS-DS208P	**Title: Linux Administration with Scripting Lab**

Course Objectives:
CO1: To write shell script programs to solve problems.
CO2: To implement some standard Linux utilities such as ls.cpetc using system calls.
CO3: To develop network-based applications and understand file structures and system communication.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a shell script that accept a file name starting and ending line numbers as arguments and display all the lines between given line no.	2
II	Write a shell script that delete all lines containing a specified word.	2
III	write a shell script to find the factorial of given integer	2
IV	Write a shell script that accept a list of file names as arguments count and report the occurrence of each word	2
V	Write a awk script to find the number of characters, words and lines in a file? 16 linked list respectively	2
VI	Write a C Program that makes a copy of a file using standard I/O and system calls?	2
VII	Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or a directory and reports accordingly. whenever the argument is a file or directory.	2
VIII	write a shell script that list the all files in a directory.	2

Text book:
1. Sobell, M. G. (2017). A practical guide to Linux commands, editors, and shell programming (4th ed.). Pearson. ISBN: 9780134774602
2. Nemeth, E., Snyder, G., Hein, T. R., & Whaley, B. (2017). UNIX and Linux system administration handbook (5th ed.). Pearson. ISBN: 9780134277554

Reference Books:
1. Foster-Johnson, E., & Welch, J. C. (2005). Beginning shell scripting. Apress.
2. Robbins, A., & Beebe, N. H. F. (2005). Classic shell scripting. O'Reilly Media.

Evaluation/Assessment Methodology	
	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes: Student will be able to:

CO1: To demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment.

CO2: Able to implement linux utilities.

CO3: To apply the concept of client-server communication by using sockets.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Advance 'C' Programming**
Course Code: 24BCS-DS201	**Title: Advance 'C' Programming**

Course Objectives:

CO1: Remember a brief description of Array data structures.
CO2: Analyze performance of Linked List and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.	8
II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists with implementation, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists.	8
III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deque, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal; Traversal of Binary Trees; Introduction of Binary Search Tree(BST).	9

	Graphs: Introduction, Terminology, Representation.	
V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Merge Sort, Heap Sort, Linear Search, Binary Search; Introduction of Hashing.	8

Text Books:

1. Aaron M. Tenenbaum**, "***Data Structures Using C***",** Pearson Education.
2. Samir Kumar Bandyopadhyay, K. N. Dey, "*Data Structures Using C",* Pearson Education.
3. Lipschutz (Schaum's Series), "*Data Structure with C",* Tata McGraw Hill Education.

Reference:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. 3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

	Evaluation/Assessment Marks
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: ***Problem Solving using C***

Program Learning Outcomes:

PO1: Remember the need of data structure for writing efficient Programs.
PO2: Analyze the performance of linked list with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structures.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Program: Certificate **Class: BSc(CS)(DS)**	**Year: I** **Semester: II**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Advance C Programming Lab**
Course Code: 24BCS-DS206P	**Title: Advance C Programming Lab**

Course Objectives:
CO1: Remember a brief description of Array data structures.
CO2: Analyze performance of Linked List and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal + ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	Write down difference between Data Type and Data Structure.	1
2.	Differentiate Linear and Non-Linear Data Structure.	1
3.	List operations on Data structure.	1
4.	Explain Linear and multidimensional array with memory implementation in primary memory including concept of row and column major.	1
5.	Give a brief overview of Sparse matrix its memory storage, types and examples.	1
6.	How do traversal work for forward and backward direction in doubly link list.	1
7.	WAP in C language for the Array Implementation of Stack.	1
8.	Write the C function for Push and Pop operations.	1
9.	Represent and analyze the concept of Stack with Link list representation.	1
10.	What are the various operations performed on the Queue?	1
11.	Write an algorithm to insert an element in a circular queue.	1
12.	Explain the different types Graph representations?	1
13.	Write down the Heap sort and give its worst case, best case and average case analysis.	1
14.	Write down the selection sort and give its worst case, best case and average case analysis.	1
15.	What is multilevel indexing in terms of tree indexes?	1

16.	What are the two methods of binary tree implementation? Explain them.	1
17.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.	1
18.	What is multilevel indexing in terms of tree indexes?	1
19.	How many passes are required for the elements to be sorted in quick sort? Explain in detail.	1
20.	Write down the function to insert an element into a queue, in which the queue is implemented as an array.	1
21.	WAP in C language for the Array Implementation of Stack.	1
22.	Write the routine to insert a element onto a queue.	1
23.	Write the complete concept of Linear Search.	1
24.	What are the applications of queue? Explain evaluation of Batch processing.	1
25.	How do you evaluate the Postfix, Prefix and Infix Expressions.	1

Reference / Text Books:

- Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
- E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
- R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Program Learning Outcomes:

PO1: Remember the need of data structure for writing efficient Programs.
PO2: Analyze the performance of linked list with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structures.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme:BSc/ BA/BBA/BCA/BTech Certificate/Diploma/Degree/ All UG Programme	**Year: I** **Semester: II**
Credits: 5 **Theory: 4** **Practical: 1**	**Course: Environment and Ecology**
Course Code: NHU-NPR-112 **NHU-NPR-112P**	**Title: Environment and Ecology** **Environment and Ecology Lab**

Course Objectives:

Subject comprised of various fields of Environmental science and their applications for the mankind. It meets the local to global requirement.

CO1: To appreciate the historical context of human interactions with the environment and to gain insights into the international efforts to safeguard the Earth's environment and resources.

CO2: To understand the concept of natural resources, identify types of natural resources, their distribution and use with special reference to India.

CO3: To develop a critical understanding of the environmental issues of concern

CO4: To describe the main types of ecosystems and their distribution in India and the world and to explain major conservation strategies taken in India.

CO5: To develop an understanding of pollution, its types and Control measures.

CO6: To gain a comprehensive knowledge of climate change, its science and response measures and to have an overview of national and global efforts to address climate change adaptation and mitigation.

CO7: To Explain major conservation strategies taken in India.

CO8: To Sensitize themselves to adverse health impacts of pollution.

Nature of Paper: AECC

Minimum Passing Marks/Credits: 40% Marks / 4 Credits
50% Marks / 1 Credits

L: 4
T: 0
P: 1 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(2Hrs./Week=1Credits)

Unit	Contents	No. of Lectures Allotted
I	**Humans and the Environment:** The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment, Indic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. Environmental Ethics and emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.	**04**

II	**Natural Resources and Sustainable Development:** Overview of natural resources: Definition of resource; Classification of natural resources-biotic and abiotic, renewable and non-renewable. Biotic resources: Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges. Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water. Soil and mineral resources: Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.	**08**
III	**Environmental Issues-Local, regional & Global:** Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. Pollution: Impact of sectoral processes on Environment;Types of Pollution-air, noise, water, soil, thermal, radioactive ;municipal solid waste, hazardous waste; transboundary air pollution; acid rain; smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Climate change. Disasters -Natural and Man-made (Anthropogenic)\	**08**
IV	**Conservation of Biodiversity & Ecosystem:** Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics• forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.	**08**
V	**Environmental Pollution & Health:** Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. Air pollution: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants- carbon monoxide, lead, nitrogen oxides, ground-level	**08**

	ozone, particulate matter and sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. Water pollution: Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. Noise pollution: Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.	
VI	**Climate change: impacts, adaptation & mitigation:** Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions- past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. Impacts, vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change. Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and *Intended Nationally Determined Contributions* (INDCs); Climate justice.	**08**
VII	**Environment management:** Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 5 lA (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001. Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis. Environmental audit and impact assessment; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Eco labeling / Eco mark scheme	**08**
VIII	**Environmental Treaties and Legislation:** An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and non• binding measures; Conference of the Parties (COP)	**08**

	Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions Major Indian Environmental Legislations: The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgements Major International organisations and initiatives: United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.	

Reference / Text Books:

1. A text book of Ecology and Environment, P.C. Joshi & Namita Joshi, Himalaya Publishing House, Mumbai
2. Ecology and Environment, P.D. Sharma, Rastogi Pub., New Delhi.
3. Ecology and Environment, H.R. Singh and Neeraj Kumar, Rastogi Publication.
4. Fundamentals of Ecology, E.P. Odum, W.B. Saunders Co., Philadelphia.
5. Essentials of Ecology & Environmental Science, S.V.S. Rana, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Fisher, Michael H. (2018) An Environmental History of India-From Earliest Times to the Twenty-First Century, Cambridge University Press.
7. Wildlife Biology. Rajesh Gopal. Approved By MoEF, New Delhi.

If the course is available as Generic Elective then the students of following departments may opt it.
NO

Prerequisite: Intermediate/Basic knowledge of life science

Evaluation/Assessment Methodology

Max. Marks

1) Class tasks/ Sessional Examination	16
2) Presentations /Seminar/Attendance	-
3) Assignments	5
4) Research Project Report	4
Seminar On Research Project Report	
5) ESE	75
Total:	**100**

Prerequisites for the course: Knowledge of Basics of Environment and Ecology (Intermediate level)

Course Learning Outcomes:

CLO1**:** Student will come up with the knowledge of field Environmental management as well as Sustainable development and benefit of mankind.

CLO2**:** Student will come up with the knowledge of Environment management.

CLO3**:** Student will come up with the knowledge of Environmental Science in cleaning the environment.

CLO4: Student will be Explain sustainable development, its goals, targets, challenges and global strategies for sustainable development.

CLO5:Student will be develop a critical understanding of the environmental issues

CLO6: The overall course outcome focused on the role of Environment management in human welfare.

CLO7: Student will be Explain major conservation strategies taken in India.

CLO8: Student will be able Sensitize themselves to adverse health impacts of pollution.

Instructional Method and Pedagogy

1. Preconditioning of the course and its blueprint shall be discussed in the beginning of the course.
2. Various teaching aids are used for smooth conduction of Lectures.
3. 75% attendance in academic sessions is mandatory.
4. Assignments shall be given at the end of each unit/topic. Extempore activity can also be organized on various topics.
5. PPT presentation method is also incorporated in teaching.
6. Case-study based learning will also be used.
7. Promotion of Ex-situ and In-situ learning.
8. Teaching-learning via organizing seminars, guest lectures, invited talks, symposium etc.
9. Identification of slow and fast learners also done during the course commencement.
10. For Slow learners, there is a provision of arrangements of extra classes/weakened classes/remedial classes for their improvement in academics. .
11. For fast learner students, extra exposure to field visit, guest lectures on advanced topics are incorporated.

PRACTICALS

NHU-NPR-112P: Environment and Ecology Lab

Marks: 50 (35 + 15) **Duration: 30 hours (1 credits)**

Case studies and fieldwork:

The students are expected to be engaged in some of the following or similar identified activities:

1. Discussion on one national and one international case study related to the environment and sustainable development.
2. Field visits to identify local/regional environmental issues make observations including data collection and prepare a brief report.
3. Participation in plantation drive and nature camps.
4. Documentation of campus biodiversity.
5. In-situ and Ex-situ Conservation Methods of Biodiversity.

ASSESSMENT FOR PRACTICAL			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Lab Performance/ Filed Work	5	Major Experiment/ Case studies	8
Quiz/ Env. Diary	5	Minor Experiment/ Case studies	6
Charts/ Model	5	Spotting	10
-	-	Viva	6
-	-	Record	5
Total	**15**	**Total**	**35**

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Data Structure and Algorithms using 'C'**
Course Code: 25BCS-DS301	**Title: Data Structure and Algorithms using 'C'**

Course Objectives:

CO1: Remember an introduction of major algorithms and brief description of Array data structures.
CO2: Analyze performance of Linked List algorithms and choose the appropriate one for a specified application.
CO3: Determine real time application usage of Stack and Queue algorithm and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.= 1 Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic Terminology, Data Structures, Classification of Data Structures, Data Structure Operations, Complexity. **Array:** Definition, Declaration, Initialization of Array, Accessing Elements of Array, Multidimensional Arrays, Sparse Matrix, Lower and Upper Triangular Matrices, Vector, Memory Representation of Array- Row Major and Column Major, Address Calculation of Array, Insertion and Deletion on Array.	8
II	**Linked List:** Introduction, Dynamic Memory Allocation, Singly Linked Lists, Operations on Linked List Such as Traversal, Insertion, Deletion and Searching, Use of Headers, Introduction to Circularly Linked Lists and Doubly Linked Lists, Two-Way Lists.	8
III	**Stacks and Queues:** Introduction and Primitive Operations on Stack, Stack Applications; Infix, Postfix, Prefix Expressions; Evaluation of Postfix Expression; Conversion among Prefix, Infix and Postfix; Recursion; Introduction and Primitive Operation on Queues, Deque, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array & Linked List, Recursive algorithms for Tree Operations such as Insertion, Deletion, Traversal; Traversal of Binary Trees; Application of Binary Trees; Binary Search Tree (BST), Insertion and Deletion in BST, B-Tree.	8

V	**Searching & Sorting Techniques:** Bubble Sort, Insertion sort, Selection sort, Merge Sort, Heap Sort, Linear Search, Binary Search and Hashing	8

Text Books:

1. Aaron M. Tenenbaum, "Data Structures Using C", Pearson Education.
2. Samir Kumar Bandyopadhyay, K. N. Dey, "Data Structures Using C", Pearson Education.
3. Lipschutz (Schaum's Series), "Data Structure with C", Tata McGraw Hill Education.

Reference

1. Robert Kruse, C. L.Tondo, "Data Structures and Program Design in C" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "Fundamentals of Data Structures", Galgotia Publications.
3. R. S. Salaria, "Data Structures & Algorithms", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

	Evaluation/Assessment Marks
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: ***Problem Solving using 'C'***

Program Learning Outcomes:

PO1: Remember the need of data structure and Algorithms for writing efficient Programs.
PO2: Analyze the performance of linked list algorithms with its versatile applications.
PO3: Develop and analyze real time application programs with concept of Stack and Queue.
PO4: Remember the conceptual and practical implementation of Major Tree Data Structure Algorithm.
PO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Program: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Data Structure and Algorithms using 'C' Lab**
Course Code: 25BCS-DS301P	**Title: Data Structure and Algorithms using 'C' Lab**

Course Objectives:
CO1: Remember an introduction of major algorithms and brief description of Array data structures.
CO2:Analyze performance of Linked List algorithms and choose the appropriate one for a specified application.
CO3:Determine real time application usage of Stack and Queue algorithm and be familiar with writing recursive methods of Stack.
CO4: Remember and understand various Tree data structure with their major data structure operations.
CO5: Remember various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort and their program implementation.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (2Hrs./Week=1Credits)

Practical Number	Contents	No. of Lectures Allotted
1.	What is an algorithm?	1
2.	Write down difference between Data Type and Data Structure.	1
3.	Differentiate Linear and Non-Linear Data Structure.	1
4.	List operations on Data structure.	1
5.	Explain Complexity.	1
6.	Define Big 'O notation.	1
7.	Define Time space Tradeoff.	
8.	Declare and Initialize Linear array.	1
9.	Write 4*4 sparse matrix.	1
10.	Write about Linked List.	1
11.	Define Data Structure, its Types and their Brief Explanation.	1
12.	What are the measures of an efficiency of an algorithm? Explain.	1
13.	Explain Linear and multidimensional array with memory implementation in primary memory including concept of row and column major.	1
14.	What do you understand by Insertion and deletion in Linear array, explain their Algorithms.	1
15.	Give a brief overview of Sparse matrix its memory storage, types and examples.	1

16.	What do you understand by complexity of an algorithm? Write down Time and Space complexity and Explain time space trade-off.	1
17.	Write an algorithm for List Creation and Traversal.	1
18.	Explain node deletion algorithms for doubly link list	1
19.	Explain the different types Graph representations?	1
20.	How many passes are required for the elements to be sorted in insertion sort? Explain in detail.	1
21.	What are the two methods of binary tree implementation? Explain them.	1
22.	Write an algorithm for Depth First Search and explain steps of algorithm with suitable example.	1
23.	Explain the situation for collision and overflow area.	1
24.	Write an algorithm for Breapth First Search and explain steps of algorithm with suitable example.	1
25.	Explain the steps of deletion in BST.	1
26.	What is multilevel indexing in terms of tree indexes?	1
27.	What are the two methods of binary tree implementation? Explain them.	1
28.	Explain Inorder, Preorder and Postorder Traversal operation on Binary tree with example.	1
29.	Write an algorithm to split a node in a B-Tree.	1
30.	Explain the differences between AVL Tree and BST.	1
31.	Explain the Prims algorithm with suitable example.	1
32.	How many passes are required for the elements to be sorted in quick sort? Explain in detail.	1
33.	Write an algorithm for Bellman Ford and explain some steps with suitable example.	1
34.	Write an algorithm Warshal algorithm and apply the steps of algorithm using suitable example.	1
35.	Explain the Straseen's Algorithm and apply the steps with suitable example.	1
36.	Explain all Greedy Programming approaches.	1
37.	Explain all pair shortest path with an example.	1
38.	Explain Longest Common Sub-Sequence Greedy Programming with an example.	1
39.	Write down the merge sort algorithm and give its worst case, best case and average case analysis.	1
40.	Write down the quick sort algorithm and give its worst case, best case and average case analysis.	1

Reference / Text Books:

1. Robert Kruse, C. L.Tondo, "*Data Structures and Program Design in C*" , Pearson Education.
2. E. Horowitz, S. Sahni & D. Mehta, "*Fundamentals of Data Structures*", Galgotia Publications.
3. R. S. Salaria, "*Data Structures & Algorithms*", Khanna Book Publishing Co. (P) Ltd.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25

Total:	**50**

Learning Outcomes:

CO1: Remember the need of data structure and Algorithms for writing efficient Programs.
CO2: Analyze the performance of linked list algorithms with its versatile applications.
CO3: Develop and analyze real time application programs with concept of Stack and Queue.
CO4: Remember the conceptual and practical implementation of Major Tree Data Structure Algorithm.
CO5: Develop various sorting programs for example bubble sort, insertion sort, selection sort, heap sort, quick sort and also able to find their complexity measures.PO3: Students can learn Complete Programming Concepts of Arrays.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: B.Sc (CS)(DS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Operating System**
Course Code: 25BCS-DS302	**Title: Operating System**

Course Objectives:

1. Analyze and evaluate the structure, functions, and types of operating systems, including their components and services.
2. Analyze and evaluate the functioning of processes and process scheduling in operating systems, including process states, context switching, threads, and scheduling algorithms.
3. To Analyze and evaluate process synchronization and deadlock handling techniques.
4. To enable students to understand and analyze memory management techniques including logical and physical address spaces, paging, segmentation, fragmentation, and virtual memory concepts.
5. Apply and analyze the concepts of file systems, disk, and I/O management to design and evaluate efficient storage and input/output subsystems in an operating system.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0
Theory - 1 Hr. = 1 Credit
Credit (4 Hrs./Week = 4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Overview of Operating Systems**: Definition of Operating System, Types of Operating Systems-Batch, Time-Sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, OS Operations, OS Services, role of an Operating system as a resource manager, Spooling, System Calls and its types, Kernel, Shell, Device drivers, OS Structures-Layered, Monolithic, Microkernel Operating Systems.	8
II	**Processes:** Definition of Process, processes address space, Principle of Concurrency, Process States, Operations of Processes, Process State Transitions, Process Control Block, Context Switching, processes involved in context switching, Threads and their management, advantages of threads, types of threads, Concept of Multithreads **Process Scheduling:** Scheduling Objectives, Scheduling criteria, Preemptive and Non-Preemptive Scheduling, Types of Schedulers, Difference between Long term and short-term Scheduler, Dispatcher, Scheduling Criteria, Scheduling Algorithms, Multi-processor Scheduling.	8
III	**Process Synchronization:** Mutual exclusion, Critical section, Critical Section Problem, Two Process Solution, Semaphores, Classical Problem of Synchronization- Bounded Buffer Problem, Producer Consumer Problem and Dinning Philosopher Problem.	8

	Deadlock: Deadlock Characterizations, Conditions for deadlock, Resource Allocation Graph, Safe state, Method for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Differentiate between deadlock prevention and avoidance, Deadlock Detection, Recovery from Deadlock.	
IV	**Memory Management:** Requirement of memory management, Logical versus Physical Address Space, Swapping, Paging, Fragmentation and its types, Compaction, Segmentation **Virtual Memory:** Virtual Memory and its advantages, Hardware and Control Structures, Demand Paging and its advantages, Page Fault, Page Replacement, Page-Replacement Algorithms, Thrashing, Causes of thrashing.	8
V	**File System**: File, Directory, File attributes, File operations, Types of files, Access Methods, Allocation Methods, File System Structure, Directory Structures and Protection, Free-Space Management. **Disk Management:** Disk Structure, Disk Scheduling Algorithm, Swap-Space Management. **I/O Management:** Principles of I/O Hardware-I/O devices, Types of Devices, Buffering and its types, Pooling, Device Controllers, Interrupt Handlers, Direct Memory Access.	8

Text Books:

1. Silberschatz and Galvin, "*Operating System Concepts*", John Wiley & Sons.
2. "Principles of Operating Systems" Author: Brian L. Stuart
3. "Understanding Operating Systems" Authors: Ann McHoes, Ida M. Flynn
4. "Operating Systems: Internals and Design Principles "Author: William Stallings

Reference:

1. Madnick & Donovan, "*Operating Systems*", Tata McGraw Hill
2. Modern Operating Systems Author: Andrew S. Tanenbaum
3. Operating Systems: Internal and Design Principles
   Author: William Stallings

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Basic knowledge of Operating System and its working.

Course Learning Outcomes:

CO1. Students will be explaining the fundamental concepts, types, operations, and structures of operating systems, and apply this knowledge to identify the role of the OS in managing system resources and processes.

CO2. Students will be able to analyze and apply key operating system concepts related to process management and scheduling, including process states, process control blocks, context switching, thread management, and various scheduling algorithms, to design efficient and concurrent process scheduling systems in multiprocessor environments.

CO3. Students will be able to analyze and apply concepts of process synchronization and deadlock management, including critical sections, semaphores and deadlock characterization, prevention, avoidance, detection, and recovery techniques, to design and evaluate concurrent systems that ensure

safe and efficient resource allocation.
CO4. Students will be able to analyze and evaluate various memory management techniques, including logical and physical address mapping, paging, segmentation, and virtual memory concepts, to effectively manage memory resources and optimize system performance.
CO5. Students **will learn and explain** the structure and management of file systems, disk management techniques, and I/O management principles, including device handling and data transfer methods, to effectively design and optimize operating system components.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Operating System Lab**
Course Code: 25BCS-DS302P	**Title: Operating System Lab**

Course Objectives:
CO1: To Implement the Banker Algorithm using C program
CO2: To implement various Page Replacement Algorithms.
CO3: To implement CPU Scheduling Algorithms and memory management algorithms.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write C programs to implement the FIFO (First-In-First-Out) Page Replacement Algorithm.	2
II	Write C programs to demonstrate Creating a New Process Using fork ().	2
III	Write C programs to implement the SJF CPU Scheduling Algorithms.	2
IV	Write C programs to simulate CPU scheduling algorithms: SJF and Round Robin to calculates waiting time and turnaround time for processes.	2
V	Implement the Contiguous File Allocation Strategies using C programs.	2
VI	Write C programs to simulate solutions to Classical Process Synchronization Problems.	2
VII	Write C programs for the implementation of SCAN disk scheduling algorithm.	2
VIII	Write a C program to implement Bankers Algorithm.	2

Reference / Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition, Wiley India Private Limited, New Delhi.
2. "Principles of Operating Systems" Author: Brian L. Stuart.
3. "Operating Systems: Internals and Design Principles "Author: William Stallings.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-

5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Identify the performance of various page replacement algorithms.
CO2: Develop banker algorithm for deadlock avoidance.
CO3: Choose the best CPU scheduling algorithm for a given problem instance.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Blockchain**
Course Code: 25BCS-DS304-1	**Title: Blockchain**

Course Objectives:
CO1: Study and understand basic concepts of Blockchain basics.
CO2: Learn about various consensus protocol used in Blockchain.
CO3: Evaluate and learn about cryptocurrency.
CO4: Learn about various security features of Blockchain.
CO5: Evaluate Blockchain Technology used in different areas.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction of Blockchain**: Foundation of Blockchain, Features of Blockchain, Need of Blockchain, Component of Blockchain, Public blockchains, Permissioned blockchains, Private blockchains, The Structure of Blockchains, The Blockchain Life Cycle, Blockchain architecture, Blockchain-as-a-Service.	8
II	**Consensus Algorithm:** Introduction of Consensus, Proof of Work (PoW), Proof of State (PoS), Proof of Authority (PoA), Hash functions, Merkle Tree, Nonce in Blockchain.	8
III	**Cryptocurrency:** Blockchain version; Currency, Smart Contracts, Dapps, History of the Bitcoin Blockchain, History of the Ethereum Blockchain, History of the Ripple Blockchain, Myth about Cryptocurrency.	8
IV	**Privacy And Security Techniques Used in Blockchain:** Hyperledger, Cryptography in Blockchain: Symmetric Cryptography, Asymmetric Cryptography, Cryptographic Hash, how security differs by blockchain types?, Keys in Cryptography.	8
V	**Blockchain Uses:** Financial Services, Medical and healthcare, Blockchain city, Education Services.	8

Text Books:
1. Mark Gates, "Blockchain-Ultimate Guide to Understand blockchain," Wise Fox Publishing
2. Vikram Dhillon, David Metcalf, Max Hooper "**Blockchain Enabled Applications"** Apress

Reference
1. Tiana Laurence, "Blockchain For Dummies,", John Wiley & Sons, Inc.

2. Melanie Swa, "Blockchain", O' Reilley.	
Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	15 - 10 - 75
Total:	**100**

Course Learning Outcomes:

CO1: Explain how a blockchain records and verifies transactions.
CO2: Contribute to the development of new blockchain protocols or standards.
CO3: Simulate cryptocurrency transactions on a test network.
CO4: Able to explain about Hyperledger used in Blockchain technology.
CO5: Compare and contrast different blockchain platforms and their suitability for specific applications.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: B.Sc. (CS)(DS)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Data Mining & Data Warehousing**
Course Code: 25BCS-DS304-2	**Title: Data Mining & Data Warehousing**

Course Objectives:
CO1: To Understand data warehousing components, architecture, and OLAP concepts.
CO2: To Comprehend data mining fundamentals, functionalities, and major issues.
CO3: To Explore classification, prediction, and association rule mining algorithms
CO4: To Learn various clustering methods including partitioning, hierarchical, and density-based approaches.
CO5: To Understand mining of complex data objects, spatial, multimedia, text, and web data.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Data Warehousing** Overview and Concepts: Data Warehousing Components, Building a Data Warehouse, Data Warehouse Architecture, Data Extraction, Cleanup, and Transformation Tools, Metadata, Reporting, Query tools and Applications, Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.	8
II	**Data Mining** Introduction: Fundamentals of Data Mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Major issues in Data Mining. Data Pre-processing, Need for Pre-processing the Data, Data Cleaning, Data Integration & Transformation, Data Reduction, Decentralization and Concept Hierarchy Generation	8
III	**Data Mining Techniques** Classification and Prediction:- Issues Regarding Classification and Prediction, Classification by Decision Tree, Bayesian Classification, Rule Based Classification, Association Rule Mining, Efficient and Scalable Frequent Itemset Mining Methods, Market Basket Analysis, Apriori Algorithm, Tree Based Algorithms, Prediction – Regression Models , Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor	8
IV	**Cluster Analysis** Clustering Overview, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Partitioning Clustering-K-Means Algorithm; Basic Agglomerative Hierarchical Clustering Algorithm, Key	8

	Issues in Hierarchical Clustering, Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods- Neural Network Approach, Outlier Analysis.	
V	**Mining Object, Spatial, Multimedia, Text and Web Data:** Mining the World Wide Web, Multimedia Data Mining, Text Mining, Web Content Mining, Web Structure Mining, Web Usage Mining Data Analysis and Visualization: Correlation, Covariance, Rank and Percentile.	8

Text Books:

1. Jiawei Han, Jian Pei, Micheline Kamber, *"Data Mining: Concepts and Techniques"*, Elsevier.
2. Margaret H. Dunham, "*Data Mining: Introductory and Advanced Topics",* Pearson Education.
3. Arun K. Pujari, *"Data Mining Techniques"*, Universities Press
4. Pieter Adriaans&DolfZantinge, *"Data Mining"*, Pearson Education

Reference

1. "Introduction to Data Mining" by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar.
2. "*Data* Warehousing, Data Mining, and OLAP" by Alex Berson and Stephen Smith.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Student is able to design data warehouse schemas and apply OLAP techniques for data analysis.
CO2: Student is able to perform data pre-processing steps like cleaning, integration, and reduction
CO3: Student is able to apply decision trees, Bayesian classification, and Apriori algorithm to real-world problems
CO4: Student is able to implement K-Means, hierarchical clustering, and DBSCAN algorithms.
CO5: Student is able to analyze and visualize data using advanced charts and reporting tools.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: III**
Credits: 2 **Theory: 2** **Practical: 0**	**Course: Basics of SQL**
Course Code: 25BCS-DS305	**Title: Basics of SQL**
Course Objectives:	
CO1: Understand the fundamentals of databases and SQL CO2: Develop foundational skills in SQL data manipulation and retrieval CO3: Apply SQL functions and filtering techniques for effective data processing CO4: Understand and implement to Execute complex queries using joins, sub queries, and set operations CO5: Implement database integrity, views, transactions, and stored procedures	
Nature of Paper: SEC	
Minimum Passing Marks/Credits: 40% Marks / 2 Credits (Internal +ESE)	
L: 2 T: 0 P: 0(In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1Credit (4 Hrs./Week=4 Credits)	

Unit	Contents	No. of Lectures Allotted
I	Introduction to Databases & SQL Basics Overview of Databases & DBMS Introduction to SQL (Structured Query Language) Types of SQL commands: DDL, DML, DCL, TCL Basic SQL syntax and conventions Creating and managing databases Creating tables (`CREATE`, `ALTER`, `DROP`) Data types in SQL Inserting, updating, and deleting data (`INSERT`, `UPDATE`, `DELETE`) Retrieving data (`SELECT`, `WHERE`, `ORDER BY`, `DISTINCT`)	6
II	Filtering, Functions, and Data Operations SQL Operators: Arithmetic, Comparison, Logical (`AND`, `OR`, `NOT`) Pattern matching with `LIKE` and wildcards NULL values and handling them (`IS NULL`, `IS NOT NULL`) Built-in SQL functions: String functions (`CONCAT`, `SUBSTRING`, `TRIM`) Numeric functions (`ROUND`, `ABS`, `CEIL`, `FLOOR`) Date/Time functions (`NOW`, `DATE`, `MONTH`, `YEAR`) Aggregate functions (`SUM`, `AVG`, `MIN`, `MAX`, `COUNT`) Grouping data with `GROUP BY` and filtering with `HAVING`	6
III	Joins, Sub queries, and Advanced Retrieval INNER JOIN, LEFT JOIN, RIGHT JOIN, * FULL JOIN, CROSS JOIN,	6

	Self-joins Nested queries / Sub queries	
IV	Constraints, Indexes, and Views Integrity constraints: PRIMARY KEY, FOREIGN KEY, UNIQUE , NOT NULL, CHECK Indexes: creation and usage Views: Creating views (`CREATE VIEW`) Updating through views Dropping views	6
V	Transactions, Security, and Stored Routines `COMMIT`, `ROLLBACK`, `SAVEPOINT` Transaction properties (ACID) User management and permissions (`GRANT`, `REVOKE`) Stored Procedures: creation, execution, parameters	6

Text Books:

1. SQL, PL/SQL – The Programming Language of Oracle by Ivan Bayross BPB Publication
2. SQL For Dummies" Author: Allen G. Taylor (Wiley Publishing)
3. "SQL: The Complete Reference" James R. Groff, Paul N. Weinberg McGraw-Hill Education

Reference

1. SQL for Data Analysis: Advanced Techniques for Transforming Data into Insights by Cathy Tanimura O REILLY
2. "SQL Cookbook" Anthony Molinaro O'Reilly Media

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Describe the fundamental concepts of databases and relational DBMS
CO2: Create and manipulate relational database objects using SQL.
CO3: Student shall be able to retrieve and process data using SQL queries and built-in functions
CO4: Explain advanced data retrieval using joins, sub queries, and set operations
CO5: Explain data integrity, manage transactions, and implement stored routines

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: III**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Basics of SQL Lab**
Course Code: 25BCS-DS305P	**Title: Basics of SQL Lab**

Course Objectives:
To learn the student should be made to:
CO1: Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
CO2: Be familiarized with a query language
CO3: Have hands on experience on DDL Commands
CO4: Have a good understanding of DML Commands and DCL commands
CO5: Familiarize advanced SQL queries and exposed to different applications

Nature of Paper: SEC

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (4 Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction to SQL and Databases , Select and use a database, View all tables in a database..	2
II	Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.	2
III	Perform the following: a. Viewing all databases, creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting b. Manage records in a table, save changes using `COMMIT`, and revert changes using `ROLLBACK`."	2
IV	Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables	2
V	For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer Join Subqueries- With IN clause, With EXISTS clause.	2
VI	For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views,	2

	Selecting from view.	
VII	Sorting and Filtering:- Use `ORDER BY` for sorting results , Use `DISTINCT` to remove duplicates, Use `BETWEEN`, `IN`, and `LIKE` for filtering.	2
VIII	Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.	2

Reference / Text Books:

1. Fundamentals of Database System By Elmasari& Navathe, 7th Edition, 2018, Pearson Education.
2. Database System Concepts by Silberschatz, Korth& Sudarshan, 6th Edition, 2019, McGraw-Hill Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Design and implement a database schema for a given problem-domain

CO2: Populate and query a database also modify the database schema

CO3: Create and maintain tables using PL/SQL and also handle the cursors.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Diploma **Class: B.Sc. (CS)(DS)**	**Year: II** **Semester: III**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Cyber Security**
Course Code: 25BCS-DS306	**Title: Cyber Security**

Course Objectives: Upon successful completion of this course, students will be able to:
CO1: Understand the foundational concepts of cyberspace and the internet's architecture.
CO2: Identify and analyze various forms of cybercrime and the legal frameworks designed to combat them.
CO3: Recognize security threats associated with social media and apply best practices for safe online interaction.
CO4: Comprehend the security aspects of e-commerce and digital payment systems, including common frauds and preventive measures.
CO5: Implement essential security measures for digital devices and utilize basic cybersecurity tools and technologies.

Nature of Paper: VAC

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	8
II	Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes-cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi , Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.	8
III	Social Media Overview and Security: Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws, regarding posting of inappropriate content, best practices for the use of social media, Case studies.	8
IV	E–Commerce and Digital Payments: Definition of E- Commerce, Main	8

	components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007,	
V	Digital Devices Security, Tools, and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	8

Text Books:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
2. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
3. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
4. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
5. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.

Reference:

1. Fundamentals of Network Security by E. Maiwald, McGraw Hill..
2. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report / Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: After completion of this module, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2: Students, at the end of this module, should be able to understand the cyber-crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

CO4: After the completion of this module, students would be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

CO5: Students, after completion of this module will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: II / Semester; IV

Programme: Diploma **Class: BSc(CS)(DS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Professional Skills**
Course Code: 25BCS-DS406	**Title: Professional Skills**

Course Objectives:

CO1: Develop professional skills by understanding personal growth, workplace behavior, and continuous professional development.
CO2: Identify and strengthen professional talents through self-assessment, communication, teamwork, and leadership skills.
CO3: Apply goal-setting techniques and career planning strategies to achieve personal and professional objectives.
CO4: Gain practical workplace exposure by participating in internships and demonstrating professional responsibility.
CO5: Demonstrate ethical behavior, inclusivity, customer orientation, and collaboration to enhance employability skills.

Nature of Paper: AECC-4

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal + ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory-1 Hr.=1Credit
Practical-2Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Professional Development: Meaning of professional development, importance of professional skills, types of professional development, lifelong learning, personal branding, work–life balance.	8
II	Identifying Professional Talents: Professional talents and skills, soft skills and hard skills, self-assessment, communication skills, teamwork, leadership, time management, emotional intelligence.	8
III	Goal Setting and Career Planning: Meaning of goals, SMART goals, steps of goal setting, career planning, self-assessment, career options, skill development, professional networking.	8
IV	Internship and Workplace Exposure: Meaning of internship, objectives of internship, types of internships, benefits of internships, employer and intern responsibilities, internship preparation.	8
V	Workplace Ethics and Employability Skills: Professional ethics, equality and equity, gender sensitivity, cultural diversity, customer service, collaboration, administrative skills, marketing and networking skills.	8

Text Books:

1. Covey, Stephen R. *The 7 Habits of Highly Effective People: Powerful Lessons in Personal Change*. Free Press, 1989.
2. Locke, Edwin A., and Gary P. Latham. *A Theory of Goal Setting and Task Performance*. Prentice Hall, 1990.
3. Oldman, Mark, and Samer Hamadeh. *The Internship Bible*. Princeton Review Publishing, 2005.
4. Sharma, Prshant.. *Soft Skills Personality Development for Life Success*. BPB Publications 20, Ansari Road, Darya Ganj, New Delhi-110002, 2019.
5. Subramanian, R. *Professional ethics* (2nd ed.). Oxford University Press India, 2014.

Reference:

1. Robbins, Stephen P., and Timothy A. Judge. *Organizational Behavior*. Pearson Education, 2017.
2. Greenhaus, Jeffrey H., Gerard A. Callanan, and Veronica M. Godshalk. *Career Management*. SAGE Publications, 2019.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Classtasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: **On completion of this module, students will be able to** understand professional development, lifelong learning, and work–life balance.

CO2: **By the end of this module, students will learn to** identify their talents and build essential soft and hard skills.

CO3: **After successful completion, students will be able to** set SMART goals and plan their careers effectively.

CO4: **At the conclusion of this module, students will be able to** understand internships and prepare for workplace exposure.

CO5: **Upon completing this module, students will be able to** apply workplace ethics and key employability skills.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: OOPs Using Java**
Course Code: 25BCS-DS401	**Title: OOPs Using Java**

Course Objectives:
CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of abstraction.
CO4: Able to understand the use of Packages and Interface in java.
CO5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to OOPs and Java:** OOPs Concepts, Top-Down Approach and Bottom Up Approach, Introduction to Java, History of Java, Features of Java, Byte Code, JVM, JRE, JDK, JIT, Java Applications, Character Set, Identifiers, Literals, Comments, Keyword, Data Type, Operators, Conditional Statements, Looping Statements, Array Declaration, Creation, Initialization. **String Handling:** Predefined Functions in String, String Methods, Command-Line Arguments.	8
II	**Classes, Objects and Methods:** Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors, Types of Constructors, this, super & static keyword, Inheritance, Types of Inheritance, Method Over Loading & Overriding, final keyword, Abstract Class.	8
III	**Interfaces and Packages:** Defining Interfaces, Extending and Implementing Interfaces, Defining Packages, Access Protection, Importing Packages, **Exception Handling:** Exception Types, Multiple Catch Clauses, Nested Try Statements, Throw, Throws, Finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses.	8
IV	**Multithreaded Programming:** Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority, Runnable interface. **Managing I/O Files:** Introduction, Streams, Stream Classes, File Class, Creation of Files, Reading and Writing to File.	8
V	**GUI Programming and Event Handling:** AWT, Swing, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like JButtons,	8

	JCheck Boxes, JRadio Buttons, JLabels, JText Fields, JText Areas, JCombo Boxes, Sliders, Windows, Menus, Dialog Box, Event handling in java, Event types, Mouse and key events. **Connecting to Database:** JDBC Type 1 to 4 drivers, Connecting to a database, querying a database and processing the results, updating data with JDBC.	

Text Books:

1. Patrick Naughton and Herbertz Schildt, "Java-2 The Complete Reference", Mc Graw Hill.
2. Ivor Horton, "Beginning Java-2", Wiley Publishing.
3. Balaguruswamy, "Programming with Java: A Primer", Tata McGraw Hill Education

Reference:

1. Horetmann Cay and Cornell Gary, "Core Java Volume – I", Pearson Education.
2. Horetmann Cay and Cornell Gary, "Core JavaTM 2, Volume II – Advanced Features", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of abstraction.
CO4: Able to understand the use of Packages and Interface in java.
CO5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: OOPs using Java Lab**
Course Code: 25BCS-DS401P	**Title: OOPs using Java Lab**

Course Objectives:
CO1: Understand and apply the fundamental concepts of Object-Oriented Programming using Java.
CO2: Solve real-world problems using Java classes, objects, inheritance, and polymorphism.
CO3: Apply abstraction, interfaces, and packages to develop modular programs.
CO4: Implement robust Java applications using exception handling and multithreading.
CO5: Create GUI-based applications and perform file/database operations using Java I/O and JDBC.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction, Basic Syntax, and Control Structures:** 1. Write a Java program to display "Hello, World!" using command-line arguments. 2. Develop a Java program for simple arithmetic operations using control statements. 3. Implement a Java program to demonstrate usage of loops (for, while, do-while). 4. Write a Java program to check whether a string is a palindrome using String methods.	3
II	**Introduction, Basic Syntax, and Control Structures:** 1. Write a Java program to use ***static and super*** keyword. 2. Implement a Java program to demonstrate usage of **constructor.** 3. Implement a Java program to demonstrate usage of **abstract classes.** 4. Implement a Java program to demonstrate usage of **Inheritance**	3
III	**Interfaces, Packages, and Exception Handling:** 1. Write a program to create and use user-defined packages. 2. Develop an application using interfaces and multiple inheritance. 3. Create a program demonstrating try, catch, finally, throw, and throws. 4. Develop a custom exception class and use it in a program to handle user-defined exceptions.	3
IV	**Multithreading and File I/O:** 1. Write a program to create threads using Thread class and Runnable interface.	3

	2. Implement thread synchronization using synchronized methods. 3. Write a Java program to create and write to a file using FileOutputStream. 4. Develop a program to read content from a file and display it using BufferedReader.	
V	**GUI Programming and Database Connectivity:** 1. Create a simple GUI form using Swing components such as JButton, JLabel, JTextField, etc. 2. Write a Java program using Swing to build a calculator application. 3. Develop a program to connect to a MySQL database using JDBC and retrieve data. 4. Implement insert, update, delete operations in a database using JDBC.	3

Text Books /Reference:

1. Patrick Naughton and Herbertz Schildt, "Java-2: The Complete Reference", Mc Graw Hill.
2. E. Balaguruswamy, "Programming with Java: A Primer", Tata McGraw Hill Education.
3. Cay S. Horstmann & Gary Cornell, Core Java Volume I & II, Pearson Education.
4. Ivor Horton, *Beginning Java 2*, Wiley Publishing.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Develop and test Java programs using object-oriented features like classes, objects, and constructors.

CO2: Implement inheritance, method overloading/overriding, and abstraction.

CO3: Apply interfaces, packages, and exception handling mechanisms in Java programs.

CO4: Develop multithreaded applications and perform file I/O operations in Java.

CO5: Design GUI-based applications with AWT/Swing and integrate database operations using JDBC.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Software Engineering**
Course Code: 25BCS-DS402	**Title: Software Engineering**

Course Objectives:

CO1: Introduce and apply various software development process models, enabling students to select the most appropriate model based on project needs.
CO2: Develop the ability to gather, analyze, and document software requirements for different kinds of software systems using industry standards.
CO3: Impart foundational knowledge of software architecture and design principles.
CO4: Familiarize students with essential concepts in software project management, including cost estimation, scheduling, and progress tracking.
CO5: Equip students with practical knowledge of software testing and debugging techniques, and the ability to assess their effectiveness in real-world scenarios.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction: Software- Characteristics and Applications, Software Engineering, Software Engineering Layers, Software Process Framework, CMM, Software Quality Attribute and Metrics, Software Development Life Cycle, Software Process ModelsWater Fall Model, Prototyping Model, RAD Model, Spiral Model, Evolutionary Models, Component-based Development Model.	8
II	Software Requirements Engineering and Analysis Modeling: Software Requirements, Requirement Engineering Process, Elicitation Requirements, Analysis and Negotiating Requirements, Requirement Specification, System Modeling, Requirements Validation, Requirement Management, Creating a Software Requirements Specification Document, IEEE Standards for SRS, Feasibility Study, Elements of Analysis Model, Data Modeling- ER Diagram, Information Modeling- DFD, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.	8
III	Software Design and Implementation: Design Process, Principles, and Design Concepts-Abstraction, Architecture, Refinement, Modularity, Data Structure, Information Hiding, Functional Independence, Cohesion, Coupling; Design Documentation, Design Strategies-Top Down and Bottom Up Design; Design ModelData Design Elements, Architectural Design, User Interface Design, Component-Level Design, Deployment-Level Design, Implementation Issues	8

	and Programming Support Environment.	
IV	Software Testing: Verification, Validation, Testing Objectives, Unit Testing, Integration Testing, Validation Testing, System Testing, Acceptance Testing, Regression Testing, Test Characteristics, White Box Testing, Basic Path Testing, Control Structure Testing, Black Box Testing, Test Plan, Test Case Design, Quality Metrics for Testing.	8
V	Software Maintenance: Nature and Need of Maintenance, Types of Maintenance (Perceptive, Preventive, Adoptive, Corrective), Cost of Maintenance, Evolution of Software, Software Maintenance Process, Software Maintenance Techniques-Reverse Engineering, Reengineering; Factors affecting Software Maintenance, Key Issues in Maintenance, Software Configuration Management, Version and Release Control, Change Control.	8

Text Books:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", Addison Wesley
2. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer

Reference:

1. K. K. Aggarwal & Yogesh Singh "Software Engineering", New Age International.
2. I. Sommerville, "Software Engineering", Pearson Education.
3. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons. 4. Subramanian Chandramouli, SaikatDutt, ChandramouliSeetharaman, B. G Geetha, "Software Engineering", Pearson Education India

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Differentiate between various software process models and justify their use in real-life software projects.

CO2: Construct data flow diagrams (DFDs), entity-relationship diagrams (ERDs), and other models to represent software requirements effectively.

CO3: Create design models including architectural, data, and user interface designs for software systems.

CO4: Design effective test plans and test cases and evaluate testing outcomes using quality metrics.

CO5: Apply maintenance techniques such as reverse engineering and reengineering in evolving software systems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Software Engineering Lab**
Course Code: 25BCS-DS402P	**Title: Software Engineering Lab**

Course Objectives:
CO1: Solve different types of case diagram.
CO2: Apply white box and black box testing.
CO3: Solve state diagram and activity diagram.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Draw the use case diagram and specify the role of each of the actors. Also state the precondition, post condition and function of each use case	2
II	Preparation of Software Requirement Specification Document and Design Documents.	2
III	Identify the classes. Classify them as weak and strong classes and draw the class diagram.	2
IV	Preparation of Software Configuration Management and Risk Management related documents	2
V	Study and usage of any Design phase CASE tool.	2
VI	Prepare a SRS document in line with the IEEE recommended standards.	2
VII	Develop test cases for unit testing and integration testing.	2
VIII	Develop test cases for various white box and black box testing techniques.	2
IX	Draw the activity diagram	2
X	Draw the state chart diagram.	

Text Books:
- RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
- Pankaj Jalote, Software Engineering, Wiley

Reference Books
- Rajib Mall, Fundamentals of Software Engineering, PHI Publication.
- K.K. Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report	-
Seminar On Research Project Report	
5) ESE	25
Total:	**50**

Course Learning Outcomes:
Student will be able to:
CO1: Able to solve different types of case diagram.
CO2: Able to apply white box and black box testing on SRS.
CO3: Evaluate state diagram and activity diagram.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programmed: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Course: Machine Learning**
Course Code: 25BCS-DS403	**Title: Machine Learning**

Course Objectives:

CO1: To understand the core principles of machine learning, including supervised, unsupervised, and reinforcement learning.
CO2: To gain proficiency in using Python libraries essential for data science, such as NumPy, Pandas, and Matplotlib.
CO3: To learn and implement various regression and classification algorithms.
CO4: To master techniques for data pre-processing, feature selection, and model evaluation to build robust ML models.
CO5: To gain hands-on experience by applying machine learning algorithms to real-world and standard datasets.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (Internal +ESE)

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Foundations of Machine Learning : Introduction to Machine Learning (ML), key terminology, and the learning process. Types of ML: Supervised, Unsupervised, Semi-supervised, and Reinforcement Learning. Role of ML in data science and big data. Datasets for ML: sources, types (training, validation, testing), and characteristics. Real-world applications and societal impact.	**8**
II	Data Science Toolkit in Python • **NumPy:** Introduction to numerical computing, creating and indexing NumPy arrays, data types, and array mathematics (transformations, reshaping, broadcasting). • **Pandas:** Introduction to Series and DataFrames. Data loading, viewing, and selection (loc, iloc). Handling missing data, basic statistical operations, and applying functions. • **Matplotlib:** Introduction to data visualization. Creating basic plots: line plots, scatter plots, histograms, and using subplots for comparative analysis.	**8**
III	Regression and Classification Models • **Regression:** Simple Linear Regression, Ordinary Least Squares (OLS). Introduction to Scikit-learn. Implementing Linear Regression with Scikit-learn on toy datasets. Model Evaluation Metrics: Mean Absolute Error	**8**

	(MAE), Mean Squared Error (MSE), and R-squared (R2) score. Regularized Regression: Ridge, Lasso, and Elastic Net. • **Classification:** Introduction to classification problems. Logistic Regression. Model Evaluation Metrics: Accuracy, Confusion Matrix, Precision, Recall, and F1-Score	
IV	Data Preprocessing and Model Tuning • **Data Scaling:** Standardization (Standard Scaler) and Normalization (MinMaxScaler, l1, l2 norms). • **Handling Missing Data:** Imputation strategies for numerical and categorical data. • **Feature Selection:** Understanding feature importance. Filter methods: Correlation, Chi-squared (X2) test, F-score, and Mutual Information. • **Model Validation & Tuning:** The importance of cross-validation (k-fold). Hyperparameter tuning using Grid Search Cross-Validation (Grid Search CV).	**8**
V	Advanced Supervised Learning Algorithms • **Decision Trees:** Classification and Regression Trees (CART) algorithm. • **Instance-Based Learning:** k-Nearest Neighbors (k-NN) algorithm. • **Support Vector Machines (SVM):** Maximal margin classifier, support vectors, and the use of kernels (linear, polynomial, RBF). • **Probabilistic Classifiers:** Naïve Bayes Classifier. • **Ensemble Methods:** Introduction to ensemble learning. Bagging (Random Forests) and Boosting (Gradient Tree Boosting).	**8**

Text Books:

1. Géron, A. (2022). *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow* (3rd ed.). O'Reilly Media.
2. Müller, A. C., & Guido, S. (2016). *Introduction to Machine Learning with Python: A Guide for Data Scientists*. O'Reilly Media.

Referential Books

1. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. Springer.
2. Bishop, C. M. (2006). *Pattern Recognition and Machine Learning*. Springer.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Artificial Intelligence

Course Learning Outcomes:

CO1: Explain the fundamental concepts of machine learning and its real-world applications.
CO2: Perform data manipulation, cleaning, and visualization using Python's data science stack.
CO3: Implement and evaluate linear and logistic regression models using Scikit-learn.
CO4: Apply various data preprocessing techniques to prepare data for machine learning models.
CO5: Build and compare different supervised learning models like Decision Trees, SVMs, k-NN, and Ensemble methods.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: IV**
Credits: 1 **Theory: 0** **Practical: 1**	**Course: Machine Learning Lab**
Course Code: 25BCS-DS403P	**Title: Machine Learning Lab**

Course Objectives:

CO1: To understand the core principles of machine learning, including supervised, unsupervised, and reinforcement learning.
CO2: To gain proficiency in using Python libraries essential for data science, such as NumPy, Pandas, and Matplotlib.
CO3: To learn and implement various regression and classification algorithms.
CO4: To master techniques for data preprocessing, feature selection, and model evaluation to build robust ML models.
CO5: To gain hands-on experience by applying machine learning algorithms to real-world and standard datasets.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits (Internal +ESE)

L: 0
T: 0
P: 2(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

S.No.	Contents	No. of Lectures Allotted
1.	**Introduction to Python Libraries:** Write programs to demonstrate the use of basic functionalities of NumPy for array manipulation.	**2**
2.	**Data Handling with Pandas:** Load a dataset (e.g., Iris or Wine) into a Pandas DataFrame. Perform data exploration by displaying the head, tail, and description of the data.	**2**
3.	**Data Visualization:** Using the Diabetes dataset, create a scatter plot to visualize the relationship between age and BMI. Use Matplotlib to add labels and a title.	**2**
4.	**Simple Linear Regression:** Implement a simple linear regression model from scratch using the Ordinary Least Squares method on a small, custom dataset.	**2**
5.	**Linear Regression with Scikit-learn:** Apply the Scikit-learn Linear Regression model on the **Diabetes dataset**. Predict the disease progression and evaluate the model using MSE and R2 score.	**2**
6.	**Logistic Regression:** Implement a logistic regression model on the **Breast Cancer dataset** for tumor classification (malignant vs. benign). Evaluate using a confusion matrix, accuracy, and precision.	**2**
7.	**Data Preprocessing:** Apply StandardScaler and MinMaxScaler on the **Wine dataset**. Compare the data distribution before and after scaling using histograms.	**2**
8.	**Handling Missing Values:** Use the **Air Quality dataset** (or a similar one with	**2**

	missing values). Implement different imputation techniques (mean, median, most frequent) to fill the missing values.	
9.	**Feature Selection:** Using the **Heart Disease dataset**, apply feature selection techniques (e.g., Chi-squared or SelectKBest) to identify the top 5 most influential features for predicting heart disease.	**2**
10.	**Cross-Validation and Hyperparameter Tuning:** Implement a k-NN classifier on the **Iris dataset**. Use GridSearchCV to find the optimal value of 'k' (neighbors).	**2**
11.	**Decision Tree Classifier:** Build a Decision Tree model on the **Car Evaluation dataset** to classify car acceptability. Visualize the resulting tree.	**2**
12.	**Support Vector Machines (SVM):** Apply an SVM classifier on the **Breast Cancer dataset**. Experiment with different kernels (linear, RBF) and compare their performance.	**2**
13.	**Naïve Bayes Classifier:** Implement a Gaussian Naïve Bayes model on the **Bank Marketing dataset** to predict if a client will subscribe to a term deposit.	**2**
14.	**Random Forest Classifier:** Use the Random Forest algorithm on the **Churn dataset** to predict customer churn. Analyze feature importance's provided by the model.	**2**
15.	**Comparative Model Analysis:** On the **Heart Disease dataset**, implement at least three different classification algorithms (e.g., Logistic Regression, SVM, Random Forest). Compare their performance using appropriate metrics and justify which model is best suited for the problem.	**2**

Text Books:

1. Géron, A. (2022). *Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow* (3rd ed.). O'Reilly Media.
2. Müller, A. C., & Guido, S. (2016). *Introduction to Machine Learning with Python: A Guide for Data Scientists*. O'Reilly Media.

Referential Books

1. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*. Springer.
2. Bishop, C. M. (2006). *Pattern Recognition and Machine Learning*. Springer.

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report / Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Prerequisites for the course: Artificial Intelligence

Course Learning Outcomes:

CO1: Explain the fundamental concepts of machine learning and its real-world applications.
CO2: Perform data manipulation, cleaning, and visualization using Python's data science stack.
CO3: Implement and evaluate linear and logistic regression models using Scikit-learn.
CO4: Apply various data preprocessing techniques to prepare data for machine learning models.
CO5: Build and compare different supervised learning models like Decision Trees, SVMs, k-NN, and Ensemble methods.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II/ Semester: IV

Programme: Diploma **Class: B.Sc.(CS)(DS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: IOT**
Course Code: 25BCS-DS404-1	**Title: IOT**

Course Objectives:

CO1: To analyze the conceptual framework, architectural components, and technological foundations of IoT and M2M communication systems, enabling students to evaluate their applications and design principles for connected devices.

CO2: Analyze and evaluate various hardware components and embedded platforms used in IoT systems, including sensors, actuators, RFID technology, and wireless sensor networks, to understand their roles and applications in real-world IoT environments.

CO3: Evaluate various wireless medium access and routing protocols used in IoT networks, and analyze strategies for sensor deployment, node discovery, and efficient data aggregation to optimize network performance.

CO4: Enable students to apply foundational programming concepts to configure and operate Arduino boards for real-world IoT applications using the Arduino IDE and relevant libraries.

CO5: Help students understand the key design, development, and security challenges in IoT systems, along with the diverse applications ranging from smart metering to smart city infrastructure.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit (3Hrs./Week=3Credits)

Unit	Contents	No. of Lectures Allotted
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	8
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	8
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.	8
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio	8

	IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	8

Text Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi"The Internet of Things key applications and protocols", willey.
2. Jeeva Jose, Internet of Things, Khanna Publishing House.
3. Michael Miller "The Internet of Things" by Pearson.
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016.
5. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1st edition, VPI publications, 2014.
6. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India.

Reference:

1. **"Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti at** Universities Press (2014)
2. **"Internet of Things: Principles and Paradigms" by** Rajkumar Buyya, Amir Vahid Dastjerdi *Publisher:* Morgan Kaufmann
3. **"Building Internet of Things with the Arduino" by** Charalampos Doukas *Publisher:* Packt Publishing
4. **"Internet of Things: Architecture and Design Principles" by** Rajkumar Buyya, Satish Narayana Srirama *Publisher:* Wiley (2020)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: By the end of the course, students will be able to design IoT/M2M systems by applying standardized communication technologies and data enrichment strategies to create affordable and efficient.

CO2: By the end of the course, students will be able to design and implement basic IoT solutions using embedded platforms such as Arduino and Raspberry Pi, integrating sensors, actuators, and wireless communication modules to solve practical problems.

CO3: Students will be able to compare and select appropriate MAC and routing protocols for specific IoT scenarios, and implement node deployment and data dissemination techniques to enhance communication efficiency within sensor networks.

CO4: By the end of this course, learners will be able to analyze and troubleshoot Arduino-based IoT systems by interpreting code behavior through emulators and physical board testing.

CO5: By the end of the course, students will be able to evaluate IoT application designs—such as smart street lighting or home automation—by identifying potential technical and security challenges and proposing viable solutions.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: B.Sc. (CS)(DS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mobile Application Development**
Course Code: 25BCS-DS404-2	**Title: Mobile Application Development**

Course Objectives:
CO1: Understand the fundamentals of Android operating system, its architecture, and development tools.
CO2: Learn the design and lifecycle of Android activities, intents, and fragments for building multi-screen applications.
CO3: Develop intuitive and interactive user interfaces using various Android views and layouts.
CO4: Implement data storage and management using SQLite database in Android applications.
CO5: Explore background services, messaging features, and the complete process of publishing Android applications.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Android:** Overview, History, Features of Android, Architecture of Android. Android Phones, SDK. Android Development Tools. Android Emulator. Creating Android Virtual Device. Creating your first Android Application.	8
II	**Activities:** Introduction, Activity Lifecycle. **Intents:** Introduction. Linking Activities using Intents. Calling built-in applications using Intents. **Fragments:** Introduction. Adding Fragments Dynamically. Lifecycle of Fragment. Interaction between fragments.	8
III	**Android User Interface:** Understanding the components of a screen. Display Orientation. **Designing Your User Interface with Views:** Basic Views. Picker Views List View Specialized Fragment, Displaying Pictures and Menes with views.	8
IV	**Databases - SQLite:** Introduction, Creating. Opening and Closing Database Working with Cursors, Insert, Update, Delete, Building and Executing Queries.	8
V	**Messaging and E-mail:** SMS Messaging and Send Email. **Developing Android Services**: Creating Services Communication between a Service and an Activity, Binding Activities to Services. **Publishing Android Application**: Preparing for abusing. Deploying APK Files.	8

Text Books:

- Lauren Darcey & Shane Conder, Android Wireless Application Development, Pearson Education, 3rd Edition.
- Barry Burd, Android Application Development All-in-One for Dummies, Wiley India, Latest Edition.

Reference

- Reto Meier & Ian Lake, Professional Android, Wrox Press, 4th Edition.
- Joseph Annuzzi Jr., Lauren Darcey, Shane Conder, Advanced Android Application Development, Addison-Wesley, 4th Edition.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar/Attendance	-
3) Assignments/TA	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcome

CO1: Describe the history, features, and architecture of Android and set up the Android development environment.
CO2: Apply activity lifecycle concepts and use intents and fragments to manage multi-screen app navigation.
CO3: Design and develop user-friendly Android applications using appropriate UI components.
CO4: Perform CRUD (Create, Read, Update, Delete) operations using SQLite in Android.
CO5: Integrate services and messaging features and prepare Android applications for deployment on the Google Play Store.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: IV

Programme: Diploma **Class: B.Sc. (CS)(DS)**	**Year: II** **Semester: IV**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Python Programming**
Course Code: 25BCS-DS404-3	**Title: Python programming**

Course Objectives:
CO1: Understand concept of python, introduction of python with using variable, keywords and Data structure.
CO2: Work with common Python data types, like integers, floats, strings as well as input and output, control flow like conditional statement and iteration loop.
CO3: Work with functions, file handling like reading, writing file, error and exceptions.
CO4: Understand concept of Module and class concept, objects.
CO5: Understand concept of advanced modules, web scrapping and regular expression.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Installing Python in Windows/Linux/Mac OS, Using Python interpreter, Execute a Script, Structuring with Indentation, Editors. **Data types and Variables:** Variables, Variables v/s identifiers, Naming convention of variables, Keywords. **Data Structure:** List, Tuples, Sets, Dictionaries	8
II	**Input And Output:** Input function, Input with raw input(),Output with old string format, Python format function **Control Flow:** If/Else Statements, For/while Statements, Range() function, Break and continue statements, Else clauses on Loops.	8
III	**Functions**: Defining Function, Default Argument, Keyword Argument, Arbitrary Arguments List. **File Handling**: Reading from the file, Writing to the file, Methods of file objects. **Error And Expectation:** Syntax Errors, Exceptions, Handling Exceptions (try, except).	8
IV	**Module**: Creating Modules, import a module, Import the names, Executing modules as scripts. **Class Concept:** Class Syntax, Class Objects, Instance Objects, Method Objects, Class and Instance Variables.	8

V	**Advanced Modules:** Regular Expressions, date time - date and time libraries, Dealing with Excel, GUI, Web Scrapping.	8

Text Books:

1. Python Cook book Author: By David Beazley and Brian K. Jones
2. **The Python Book: The Ultimate Guide to Coding with Python by Aaron Asadi (ed.)**

Reference:

1. Python-(Mark Lutz)
2. Python Training guide (BPB Publications)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations/Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: Data Mining

Course Learning Outcomes:

CO1: Students should be able concept of python with using variable and Data Structure.
CO2: Students should be able and work with data types, input and output, conditional statement and iteration loop.
CO3: Ability to explore with function, file handling, error and exceptions.
CO4: Students should be able to working with module and class concept.
CO5: Students able to working with regular expression and module.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)(DS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: ERP**
Course Code: BCS-NEP-503	**Title: ERP**

Course Objectives:

CO1: To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
CO2: To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
CO3: To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
CO4: To develop a process driven thinking towards business processes.
CO5: To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal +ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to ERP:** Evolution of ERP;. what is ERP?, Reasons for the Growth of ERP; Scenario and Justification of ERP in India;. Evaluation of ERP; Various Modules of ERP;. Advantage of ERP.	8
II	**An Overview of Enterprise:** An Overview of Enterprise;. Integrated Management Information;. Business Modelling;. ERP for Small Business;. ERP for Make to Order Companies;. Business Process Mapping for ERP Module Design;. Hardware Environment and its Selection for ERP Implementation	8
III	**ERP and Related Technologies:** ERP and Related Technologies;. Business Process Reengineering (BPR);. Management Information System (MIS);. Executive Information System (EIS);. Decision support System (DSS);. Supply Chain Management (SCM).	8
IV	**ERP Market:** Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Co, System Software Associates, Inc. (SSA); QAD; A Comparative Assessment and Selection of ERP Packages and Modules.	8
V	**ERP Implementation Lifecycle:** Issues in Implementing ERP Packages;. Pre-	8

	evaluation Screening;. Package Evaluation;. Project Planning Phase; Gap Analysis; Reengineering; Configuration; Implementation; Team Training; Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).	

Text Books:

1. Daniel E.O' Leary, Enterprise Resource Planning Systems, Cambridge University Press, 2002.
2. Ellen Monk, Bret Wagner, Concepts in Enterprise resource planning, Cengage learning, Third edition, 2009.

Reference

1. Enterprise Resource Planning – Alexis Leon – Second Edition – TMH
2. Manufacturing Resource Planning (MRP II) with Introduction to ERP; SCM; an CRM by Khalid Sheikh, Publisher: Mc. Graw-Hill

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Make basic use of Enterprise software, and its role in integrating business functions.
CO2: Analyze the strategic options for ERP identification and adoption.
CO3: Design the ERP implementation strategies.
CO4: Analyse the strategic options for ERP identification and adoption.
CO5: Create reengineered business processes for successful ERP implementation.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)(DS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Big Data**
Course Code: BCS-NEP-503	**Title: Big Data**

Course Objectives:

CO1: Demonstrate knowledge of Big Data Analytics concepts and its applications in business.
CO2: Demonstrate functions and components of Map Reduce Framework and HDFS.
CO3: Develop queries in NoSQL environment
CO4: Explain process of developing Map Reduce based distributed processing applications.
CO5:Explain process of developing applications using HBASE, Pig etc.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	8
II	**Map-Reduce:** Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce.	8
III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop.	8

IV	**Hadoop Eco System and YARN:** Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. **NoSQL** Databases: Introduction to NoSQL MongoDB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections	8
V	**Hadoop Eco System Frameworks**: Applications on Big Data using Pig, Hive and HBase. **Pig** : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, **HBase** – Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Infosphere, BigI nsights and Big Sheets, introduction to Big SQL.	8

Text Book:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
2. Big-Data Black Book, DT Editorial Services, Wiley.

Reference Book:

1. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons
2. Pete Warden, “Big Data Glossary”, O’Reilly

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations/Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the concept of HDFS and map reduce.
CO1: Able to gather large data from a range of data sources.
CO3: Able to understand the hadoop ecosystem components
CO4: Able to explain the architecture of pig and hive with different operations.
CO5: Able to understand the importance and challenges of big data.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)(DS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Data communication network**
Course Code: BCS-NEP-503	**Title: Data communication network**

Course Objectives:
CO1: To introduce the various types of computer networks.
CO2: To explore the various layers of OSI Model.
CO3: To introduce UDP and TCP Models.
CO4: To identify various application layer protocols.
CO5: To demonstrate the TCP/IP and OSI models

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Data Communications: Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, Transmission modes, Multiplexing, Transmission Media, Switching, Circuit Switched Networks	8
II	Data link layer: Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, HDLC, Point to Point Protocols. ALOHA, CSMA/CD, LAN – Ethernet IEEE 802.3, IEEE 802.5 – IEEE 802.11, Random access, Controlled access, Channelization.	8
III	Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services,	8
IV	Network layer: Logical Addressing, Internetworking, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.	8
V	Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.	8

Text Books:
1. Data Communications and Networking, Behrouz A. Farozan , Fourth Edition TMH,2006.
2. Computer Networks, Andrew S Tanenbaum, 4th Edition. Pearson Education, PHI.

Reference:

1. Data communications and Computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, Pearson Education.
3. Computer Networking: A Top-Down Approach Featuring the Internet. James Kurose& Keith W. Ross, 3 rd Edition, Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1. Students should understand and explore the basics of Computer Networks and Various Protocols.
CO2. Students will be able to administrate a network and flow of information.
CO3. Able to understand the World Wide Web Concepts.
CO4. Able to understand the concepts of network security
CO5. Able to secure device from network issues.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)(DS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: SPT V- Advance Machine Learning**
Course Code: BCS-NEP-511	**Title: Advance Machine Learning**

Course Objectives:
CO1: Building the fundamentals of statistics.
CO2: Imparting design thinking capability to build conditional probability.
CO3: Developing design skills of models for conditional probability problems.
CO4: Gaining practical experience in tools for data analysis.
CO5: Empowering students with tools and techniques used in data science.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Statistics:** Data and its type - Quantitative and Qualitative Data, Population - Census and Sample, Statistics and its types - Descriptive vs. Inferential Statistics, Measurement of Central Tendency - Mean, Median and Mode. Quartiles, Quintiles, Deciles, & Percentiles, Dispersion and its measurement – Index of dispersion, Coefficient of Dispersion, Interquartile Range. Moments and its equations, Symmetry – Symmetrical data and asymmetrical data. Skewness – Positively and Negatively. Kurtosis – Platykurtic, Leptokurtic and Mesokurtic.	8
II	**Probability:** Random Experiments and Probabilities - Random Experiments, Probability. ,Basic introduction to probability - sampling and sample space, events, empirical definition of probability. Types of events - Simple and compound, dependent and independent, impossible and sure, equally, likely, exhaustive, etc. Logical connectivity in probability - Negation (not), (Conjunction) and, (Disjunction) or, (Conditional) if then, (Biconditional) if and only if. General Probability Rules of probability - Addition Rule, Multiplication Rule, Conditional Probability, Law of total probability.	8
III	Baye's Theorem, prior and posterior probability, More on Conditional Probability (numerical), and Multiplication Theorem on Probability (numerical). Bernoulli Trials And Binomial Distribution, and its approach of Probability. Discrete and Continuous models in probability, probability distribution of random variable (their mean and variance). Probability	8

	distributions - Theoretical Distribution - Binomial Distribution, Poisson Distribution, Normal (Gaussian) Distribution. Understanding Normal (or Gaussian) Distribution characteristics mean and variance.Standard Normal Distribution curve and area under the curve, Interquartile range, box and whisker plot.	
IV	**Exploratory Data Analysis (EDA):** Introduction to Inferential Statistics. What is EDA. Population and Sampling , Central Limit Theorem. Basics of Hypothesis Testing. Statistical and Practical Significance. Null and Alternate Hypothesis. Errors – Type 1 and Type 2. Z tables – Finding Critical Values. The p-Value. Testing for means, variances and proportions. One sample – z test, t test, proportions test and variance test. Two sample – z test, t test (equal, unequal variances and paired), proportions test and variance test. Analysis of Variance (ANOVA).Goodness of Fitness.	8
V	**Correlation and Regression:** Correlation Coefficient. ,Predicting Data – Regression and Classification. Linear models - Linear regression and Logistic regression. Linear regression equation. Errors – mean absolute error and mean squared error. Classification with Logistic regression. Model accuracy evaluation.	8

Text Books:

1. Mining of Massive Datasets. v2.1, Jure Leskovek, Anand Rajaraman and Jefrey Ullman.,Cambridge University Press. (2019). (free online)
2. Big Data Analytics, paperback 2nd ed., Seema Acharya, Subhasini Chellappan, Wiley (2019).

Reference

1. Doing Data Science, Straight Talk From The Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly (2014).
2. Data Mining: Concepts and Techniques", Third Edition, Jiawei Han, Micheline Kamber and Jian Pei, ISBN 0123814790, (2011).
3. Big Data and Business Analytics, Jay Liebowitz, CRC press (2013)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Apply data visualization in statistics analytics
CO2: Apply data pre-processing techniques
CO3: Able to use distinct approach of probability.
CO4: Able to utilize EDA and inference.
CO5: Able to use correlation and regression techniques.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)(DS)**	**Year: III** **Semester: V**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: SPT V-Advance Machine Learning Lab**
Course Code: BCS-NEP-512P	**Title: Advance Machine Learning Lab**

Course Objectives:
CO1: Understand the basic of statistics and graph plotting.
CO2: Exposure on solving of data science problems.
CO3: Understand the classification and Regression Model.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal + ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk Location.	2
II	Find the data distributions using box and scatter plot.	2
III	Find the outliers using plot.	2
IV	Plot the histogram, bar chart and pie chart on sample data.	2
V	Find the correlation matrix.	2
VI	Plot the correlation plot on dataset and visualize giving an overview of relationships among data oniris data.	2
VII	Apply regression Model techniques to predict the data on dataset.	2
VIII	Apply multiple regressions, if data have a continuous independent variable. Apply on dataset.	2

Reference / Text Books:

1. Rachel Schutt & O'neil, "Doing Data Science", O'REILLY, ISBN:978-1-449-35865-5, 1st edition, October 2013.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	-
2) Presentations /Seminar	-
3) Assignments	-
4) Practical/Research Project Report Seminar On Research Project Report	25
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to :

CO1: Ensure the development of students applied skills in data science related areas.

CO2: Able to identify the elements involved in analyses of data.

CO3: Students will gain knowledge in apply a number of different data science tools to a given scenario.

CO4: Able to implement data collection and preservation.

CO5: Able to analyze acquisition methods for data to be use in correlation and regression techniques.

Format-3

IIMTU-NEPIMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSC(CS)(DS)**	**Year: III** **Semester: V**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: SPT VI-Cyber Security**
Course Code: BCS-NEP-513	**Title: Cyber Security**

Course Objectives:

CO1: Understand the various tools and methods used in cybercrime.
CO2: Identify risk management processes, risk treatment methods, organization of information security.
CO3: Classify cyber security solutions and information assurance.
CO4: Examine software vulnerabilities and security solutions to reduce the risk of exploitation.
CO5: Analyze the cyber security needs of an organization.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Ethical Hacking:** Key issues plaguing the information security world, incident management process, and penetration testing, **Foot printing and Reconnaissance:** Various types of footprints, footprints tools, and countermeasures.	8
II	**Scanning Network:** Network scanning techniques and scanning countermeasure.	8
III	**Enumeration & Vulnerability Analysis:** Enumeration techniques and enumeration countermeasure. Vulnerability Analysis using different tools.	8
IV	**System Hacking & Malware Threats:** System Hacking Methodology, Steganography, Steg analysis attacks and covering tracks. Different types of Trojan, Trojan analysis and Trojan countermeasures, working of viruses, Virus analysis, computer worms, malware analysis procedure and communication.	8
V	**Sniffing & Social Engineering:** Packet sniffing techniques , identify theft , and social engineering countermeasure	8

Text Books:

1. K. Kumar," Cyber Laws: Intellectual property & E Commerce, Security", 1st Edition, Dominant Publisher,2011.
2. Rodney D. Ryder, "Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.

Reference

1. Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2nd Edition, PHI, 2003.
2. Justice Yatindra Singh, "Cyber Laws", Universal Law Publishing, 1st Edition, New Delhi,

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Data Mining

Course Learning Outcomes:

CO1: Able to analyze and evaluate the cyber security needs of an organization.
CO2: Able to determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation.
CO3: Able to measure the performance and troubleshoot cyber security systems.
CO4: Implement cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software/tools.
CO5: Comprehend and execute risk management processes, risk treatment methods, and key risk and performance indicators

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: V

Programme: Degree **Class: BSc(CS)(DS)**	**Year: III** **Semester: V**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: SPT VI Cyber Security Lab**
Course Code: BCS-NEP-514P	**Title: Cyber Security Lab**

Course Objectives:
CO1: Provide practical application of cyber security concepts learned in theory.
CO2: Familiarize students with a wide range of security tools and technologies used in the field.
CO3: Emphasize ethical and legal considerations in the field of cyber security.
CO4: Stay updated with the latest trends, threats, and advancements in cyber security.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal + ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=2Credits)

Unit	Contents	No. of Lectures Allotted
I	Checklist for reporting cybercrime at Cybercrime Police Station.	2
II	Checklist for reporting cybercrime online.	2
III	Basic checklist, privacy and security settings for popular Social media platforms.	2
IV	Checklist for secure net banking.	2
V	Setting and configuring two factor authentication in the Mobile phone.	2
VI	Installation and configuration of computer Anti-virus.	2
VII	Wi-Fi security management in computer and mobile.	2
VIII	Setting and configuring two factor authentications in the Mobile phone.	2

Reference / Text Books:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010.
2. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt. Ltd.
3. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
4. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
5. Fundamentals of Network Security by E. Maiwald, Mc.Graw Hill.

If the course is available as Generic Elective then the students of following departments may opt it.

Evaluation/Assessment Methodology

Max. Marks: 50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-

4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to :

CO1: After completion of this module, students would be able to understand the concept of Cyber security and issues and challenges associated with it.

CO2: Students, at the end of this module, should be able to understand the cybercrimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.

CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online Social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.

CO4: After the completion of this module, students would be able to understand the basic concepts related to E-Commerce and digital payments. They will become familiar with various digital payment modes and related cyber security aspects, RBI guidelines and preventive measures against digital payment frauds.

CO5: Students, after completion of this module will be able to understand the basic security aspects related to Computer and Mobiles. They will be able to use basic tools and technologies to protect their devices.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III Semester: VI

Programme: Degree **Class: BSC CS(DS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Advance Data Science(SPT-VII)**
Course Code: BCS-NEP-611	**Title: Advance Data Science**

Course Objectives:
CO1: Building the fundamentals of python pandas..
CO2: Imparting design thinking capability to build big-data
CO3: Identify the techniques for analysing different types of Data.
CO4: Provide the concepts and need of Data Visualization.
CO5: Provide different Use cases of Data Science Applications.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Numerical Python Pandas plotting:** Numpy recap – numpy arrays, array indexing, data-types, transposing flattening, and reshaping arrays, array mathematics, array broadcasting. Pandas – series and dataframes, viewing data, data selection, operations (functions), handling missing data. Plotting with matplotlib – linear and scatter plots, subplots.	8
II	**Imputation of Missing values:** Type of missing values, values considered "missing" (in pandas), handling missing values – mean, median and mode, Univariate feature imputation (sklearn .impute. Simple Imputer), multivariate feature imputation, nearest neighbors imputation (sklearn. impute. KNN Imputer), filling of missing values with machine learning models (decision trees). **Time Series Analysis:** Introduction, Autocorrelation and Partial Autocorrelation, Time Series – Stationarity and Seasonality, Autoregressive Model, Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF), Moving Average Model, Autoregressive Moving Average (ARMA) Model, Autoregressive Moving Average (ARMA) Model, Autoregressive Integrated Moving Average (ARIMA).	8
III	**Remote Data Access:** Introduction, stocks data – S&P 500 Index, introduction to pandas-datareader	8

	and yahoo finance, accessing remote data with pandas-datareader, Quandl, and St.Louis FED (FRED). **Handling and Visualization of Geospatial data:** Basemap introduction, plotting maps with basemaps, introduction to Open Street Map (OSM), introduction osmnx, geo-dataframes – nodes and edges, plotting geo-dataframes and maps with osmnx, finding loading and plotting gpx (gps) files, making maps attractive with folium.	
IV	**Introduction to Big Data :** Introduction, characteristics of big data, advantage of big data processing, use cases and challenges. Apache Hadoop, Hadoop architecture, Hadoop Distributed File System (HDFS), YARN (Yet Another Resource Negotiator), Hadoop MapReduce. Apache Spark, Directed Acyclic Graph (DAG), Spark ecosystem – Spark Core, Spark SQL, Apache Spark MLlib (Machine Learning) and GraphX	8
V	**Big Data Analysis – PySpark:** Spark Session, creating spark DataFrame, Untyped Dataset Operations (aka DataFrame Operations), scalar and aggregate functions, read and writing (saving) DataFrame, Resilient Distributed Datasets (RDDs) – parallelized collections, RDD Operations, transformations and actions. Running SQL Queries on RDD.	8

Text Books:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline. O'Reilly.
2. Jure Leskovek, AnandRajaraman and Jeffrey Ullman. Mining of Massive Datasets.v2.1, Cambridge University Press.

Reference

1. Joel Grus, Data Science from Scratch, O'Reilly Publications.
2. Davy Ceilen, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Dream Tech Publications.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving ability

Course Learning Outcomes:

CO1: Identify the various steps to numpy plotting for data.
CO2: Understand the need of data collection, storage and processing of data for better insights.
CO3: Apply the different statistical measures for data analysis with confidence
CO4: Identify the appropriate techniques for understanding data through Visualization
CO5: Able to identify and type of data science techniques for analysis.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: B.SC(CS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Computer Graphics (SPT-VIII)**
Course Code: BCS-NEP-613	**Title: Computer Graphics (SPT-VIII)**

Course Objectives:
CO1: Solve different types of display techniques.
CO2: Apply Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Solve 2DTransformations and Composition of 3-D Transformation.
CO4: Apply Point, Text, Line, Polygon Clipping and Cohen-SutherlandClipping Algorithm
CO5: Solve Pipeline and Different Types of Projections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basic of Computer Graphics, Uses of Computer Graphics, Shadow mask techniques, CRT working, Visual Display Devices-Refresh CRT, Raster-Scan Displays, Random-Scan Displays, Color-CRT Monitors, DVST, Flat Panel Displays, 3-D Viewing Devices, Stereoscopic and Virtual-Reality Systems; Raster-Scan System, Random Scan System, Input/ Output Devices, Hard-Copy Devices, Color Models: RGB, CMY, HSV, HLS Color Models.	8
II	**Output Primitives Algorithms:** Scan Conversion: Point, Line, Circle, Ellipse, Polygon; Filled area Algorithms: Scan-line Polygon Fill Algorithm, Boundary-Fill Algorithm, Flood-Fill Algorithm, Aliasing, and Introduction to Anti-Aliasing.	8
III	**Geometric Transformations:** 2-Dimensional Transformations (Translation, Rotation, Scaling, Reflection, Shear, Inverse Transformation, Composite Transformation, Homogeneous Coordinates and Matrix Representation, Matrix Representation of 3-D Transformations, Composition of 3-D Transformation.	8
IV	**Two-Dimensional Viewing and Clipping:** Viewing Pipeline, The Window-to-View port Transformations, Convex and Concave Clipping, Point Clipping, Line Clipping-Cohen-Sutherland Polygon Clipping, Liang-Bar sky Line Clipping, Cyrus-Beck Algorithm, Midpoint Sub division Algorithm; Sutherland-Hodgeman Polygon clipping.	8
V	**Three-Dimensional Viewing and Clipping:** Viewing Pipeline, Projections, Types of Projections, The Mathematics of Planner Geometric Projections,	8

	Parametric Representation of Curves: Bezier Curves, B-Spline Curves, Z-Buffer algorithm, Scan Line Algorithm, Area subdivision algorithm	

Reference:

1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press.
2. John Vince, "*Mathematics for Computer Graphics",* Springer.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Learned and Solved different types of display techniques..
CO2: WAP for Point, Line, Circle, Ellipse, Polygon algorithm.
CO3: Learned and Solved 2DTransformations and Composition of 3-D Transformation.
CO4: Applied Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm
CO5: Learned and Solved Pipeline and Different Types of Projections techniques.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)(DS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Mobile Computing**
Course Code: BCS-NEP-603	**Title: Mobile Computing**

Course Objectives:
CO1: To understand the basic concepts of mobile computing.
CO2: To learn the basics of mobile data management system.
CO3: To be familiar with the network layer protocols and Ad-Hoc networks.
CO4: To know the basis of transaction and application layer protocols.
CO5: To gain knowledge about different mobile platforms and application development.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**Mobile Computing:** Issues in Mobile Computing, Wireless Telephony, Digital Cellular Standards, Bluetooth Technology, Wireless Multiple Access Protocols, Channel Allocation in Cellular Systems. Wireless Application Protocol, WRITE A PROGRAM technology, Mobile Information device, Mobile Computing Applications.	8
II	**Data Management Issues:** Mobility, Wireless Communication and Portability, Data Replication and Replication Schemes, Basic Concept of Multihopping, Adaptive Clustering for Mobile Network, Multicluster Architecture.	8
III	**Location Management:** Location Based Services, Automatically Locating Mobile Uses, Locating and Organizing Services, Issues and Future Directions, Mobile IP, Comparison of TCP and Wireless.	8
IV	**Transaction Management:** Data Dissemination, Cache Consistency, Mobile Transaction Processing, Mobile Database Research Directions, Security Fault Tolerance for Mobile N/W.	8
V	What is Ad-hoc Network? Problems with Message Routing in Wireless Ad-hoc Mobile Networks, Routing scheme based on signal strength, Link state and Distance Vector routing protocols, Ad-hoc on Demand Distance Vector.	8

Text Books:

1. Shambhu Upadhyaya, Abhijeet Chaudhary, Kevin Kwiat, Mark Weises, "Mobile Computing", Kluwer Academic Publishers.
2. UWE Hansmann, Lothar Merk, Martin-S-Nickious, Thomas Stohe, "Principles of Mobile

Computing", Springer International Edition.
3. Wireless and Mobile Networks Architectures, by Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001.

Reference

1. Mobile and Personal Communication systems and services, by Raj Pandya, Prentice Hall of India, 2001.
2. Wireless Web Development, Ray Rischpater, Springer Publishing, 2000.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Understand about mobile communication with their different routing algorithms.
CO2: Apply different data backup schemes used in mobile network to store the data.
CO3: Able to explain about location management that is much important for mobile network.
CO4: Build the knowledge of how transactions are done through mobile, different security issues while mobile transaction.
CO5: Appraise different routing protocols used for routing the path like ADDV, DSR, FSR etc.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)(DS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: E-Commerce**
Course Code: BCS-NEP-603	**Title: E-Commerce**

Course Objectives:
CO1: Impart the students with knowledge and understanding of contemporary trends in e-commerce.
CO2: Explain electronic system and Internet.
CO3: Describe the use of e-commerce security.
CO4: To provide adequate knowledge and understanding about E-Com practices to the students.
CO5: Understand the usage of planning and marketing for e-commerce.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**An introduction to Electronic commerce**: What is E-Commerce (Introduction and Definition), Main activities E-Commerce. Goals of E-Commerce, Technical Components of E-Commerce, Functions of E-Commerce, Advantages and disadvantages of E-Commerce, Scope of E-Commerce, Electronic Commerce Applications, Electronic Commerce and Electronic Business(C2C)(C2G;G2G, B2G, B2P, B2A, P2P, B2A, C2A, B2B, B2C)	8
II	**The Internet and WWW:** Evolution of Internet, Domain Names and Internet Organization (.edu, .com, .mil, .gov, .net etc.) , Types of Network, Internet Service Provider, World Wide Web, Internet & Extranet, Role of Internet in B2B Application, building own website, Cost, Time, Reach, Registering a Domain Name, Web promotion, Target email, Barter, Exchange, Shopping Bots	8
III	**Internet Security:** Secure Transaction, Computer Monitoring, Privacy on Internet, Corporate Email privacy, Computer Crime(Laws , Types of Crimes), Threats, Attack on Computer System, Software Packages for privacy, Hacking, Computer Virus(How it spreads, Virus problem, virus protection, Encryption and Decryption, Secret key Cryptography, DES, Public Key Encryption, RSA, Authorization and Authentication, Firewall, Digital Signature.	8
IV	**Electronic Data Exchange:** Introduction, Concepts of EDI and Limitation, Applications of EDI, Disadvantages of EDI, EDI model, Electronic Payment System: Introduction, Types of Electronic Payment System, Payment Types, Value Exchange System, Credit Card System, Electronic Fund Transfer, Paperless bill, Modern Payment Cash, Electronic Cash	8

V	**Planning for Electronic Commerce:** Planning Electronic Commerce initiates, Linking objectives to business strategies, Measuring cost objectives, Comparing benefits to Costs, Strategies for developing electronic commerce web sites. **Internet Marketing;** The PROS and CONS of online shopping, The cons of online shopping. Justify an Internet business, Internet marketing techniques, The E-cycle of Internet marketing, Personalization e-commerce.	8

Text Books:

1. G.S.V.Murthy, E-Commerce Concepts, Models, Strategies-Himalaya Publishing House, 2011.
2. Kamlesh K Bajaj and Debjani Nag, E- Commerce, 2005.

Reference

1. Gray P. Schneider, Electronic commerce, International Student Edition, 2011.
2. E-Commerce, Fundamentals and Applications, Wiely Student Edition,

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Identify and explain fundamental web site tools including design tools, programming tools, and data processing tools.
CO2: Apply the solutions on finding major electronic payment issues and options.
CO3: Acquire the knowledge of security issues and explain procedures used to protect against security threats.
CO4: Communicate effectively in ways appropriate to the discipline, audience and purpose.
CO5: Implement the corrective measures to management issues underlying e-Commerce issues including organizational structure, strategic planning, goal setting.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)(DS)**	**Year: III** **Semester: VI**
Credits: 4 **Theory: 4** **Practical: 0**	**Course: Real Time System**
Course Code: BCS-NEP-603	**Title: Real Time System**

Course Objectives:
CO1: To study the basic of tasks and scheduling.
CO2: To understand programming languages and databases.
CO3: To analyze real time communication.
CO4: To analyze evaluation techniques and reliability models for Hardware Redundancy.
CO5: To understand clock synchronization.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits Internal + ESE)

L: 4
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	**INTRODUCTION TO TASK SCHEDULING:** Introduction - Issues in Real Time Computing, Structure of a Real Time System, Task classes, Performance Measures for Real time Systems, Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms, RM algorithm with different cases.	8
II	**UNI AND MULTI PROCESSOR SCHEDULING :** Uniprocessor scheduling of IRIS tasks, Task assignment, Utilization balancing – Next fit- Binpacking- Myopic off-line - Focused addressing and bidding- Buddy strategy- Fault Tolerant, Scheduling. -Aperiodic scheduling - Spring algorithm.	8
III	**REAL TIME COMMUNICATION :** Introduction – VTCSMA – PB CSMA- Deterministic collision resolution protocol- DCR for multi packet messages- dynamic planning based- Communication with periodic and a periodic messages.	8
IV	**REAL TIME DATABASES :** Basic Definition, Real time Vs General purpose databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Maintaining Serialization Consistency, Databases for Hard Real Time System.	8
V	**REAL-TIME MODELING AND CASE STUDIES :** Petrinets and applications in real-time modeling, Air traffic controller system –	8

	Distributed air defence system.	

Text Books:

1. Jane W. S. Liu, "Real-time systems", 1st Edition, Prentice Hall, 2000.
2. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wiley & Sons,2004.
3. C. Siva Ram Murthy, G. Manimaran, "Resource management in real-time systems and networks", PHI, 2009.

Reference

1. C.M. Krishna, Kang G. Shin, "Real Time Systems", Tata McGraw - Hil, 2010.
2. Giorgio C. Buttazzo , "Hard real-time computing systems: predictable scheduling algorithms and applications" , Springer, 2008.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	10
4) Research Project Report Seminar On Research Project Report	-
5) ESE	75
Total:	**100**

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Understand the features and structures of practical Operating System implementations.
CO2: Acquire practical knowledge Real Time Operating Systems used in embedded system.
CO3: Understand the use of multitasking techniques in Real Time Systems.
CO4: Compare different scheduling algorithms and the schedulability criteria.
CO5: Analyze real time systems with regard to keeping time and resource restrictions.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)(DS)**	**Year: III** **Semester: VI**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Advanced Data Science Lab (SPT- VII)**
Course Code: BCS-NEP-612P	**Title: Advanced Data Science Lab (SPT- VII)**

Course Objectives:
CO1: Perform various operations on numpy arrays
CO2: Importing data from different file formats using pandas.
CO3: Draw different types of charts using matplotlib.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L: 0
T: 0
P: 4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit (4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Creating a NumPy Array a. Basic ndarray b. Array of zeros c. Array of ones d. Random numbers in ndarray	2
II	The Shape and Reshaping of NumPy Array a. Dimensions of NumPy array b. Shape of NumPy array c. Size of NumPy array d. Reshaping a NumPy array	2
III	Expanding and Squeezing a NumPy Array a. Expanding a NumPy array b. Squeezing a NumPy array c. Sorting in NumPy Arrays	2
IV	Perform following operations using pandas a. Creating dataframe b. concat () c. Setting conditions d. Adding a new column	2
V	Read the following file formats using pandas a. Text files b. CSV files c. Excel files	2

	d. JSON files	
VI	Demonstrate web scraping using python.	2
VII	Perform following preprocessing techniques on loan prediction dataset: Feature Scaling, Feature Standardization, Label Encoding	2
VIII	Perform following visualizations using matplotlib Bar Graph, Pie Chart, Box Plot, Histogram, Line Chart and Subplots, Scatter Plot	2

Reference / Text Books:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.
2. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016.

If the course is available as Generic Elective then the students of following departments may opt it.

Evaluation/Assessment Methodology

Max. Marks:50

1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25
Total:	**50**

Course Learning Outcomes:

Student will be able to :

CO1: Apply principles of NumPy and Pandas to the analysis of data.
CO2: Make use of various file formats in loading and storage of data.
CO3: Identify and apply the need and importance of pre-processing techniques.
CO4: Show the results and present them in a pictorial format.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: III / Semester: VI

Programme: Degree **Class: BSC(CS)(DS)**	**Year: III** **Semester: VI**
Credits: 2 **Theory: 0** **Practical: 2**	**Course: Computer Graphics Lab (SPT-VIII)**
Course Code: BCS-NEP-614P	**Title: Computer Graphics Lab (SPT-VIII)**

Course Objectives:
CO 1: Solve different types of display techniques.
CO 2: Apply Point, Line, Circle, Ellipse, Polygon algorithm.
CO 3: Solve 2DTransformations and Composition of 3-D Transformation.
CO 4: Apply Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm
CO 5: Solve Pipeline and Different Types of Projections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (Internal +ESE)

L: 0
T: 0
P: 4 (In Hours/Week)
Practical- 2 Hrs.=1Credit (4Hrs./Week=2 Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a Program to draw basic graphics construction like line and Hut.	2
II	Write a Program to draw basic graphics construction like circle and transistor.	2
III	Write a Program to draw basic graphics construction like arc and moving images.	2
IV	Write a Program to draw basic graphics construction like ellipse and different shapes.	2
V	Write a Program to draw basic graphics construction like rectangle and smile face	2

Text Books:
1. D. Hearn & M.P. Baker, "*Computer Graphics*", Pearson Education.
2. Foley, VanDam, Feiner, Hughes, "*Computer Graphics: Principles & Practice*", Addison Wesley Professional.

Reference:
1. Steve Marschner, Peter Shirley, "*Fundamentals of Computer Graphics",* CRC Press.
2. John Vince, "*Mathematics for Computer Graphics",* Springer.

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination	25
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	25

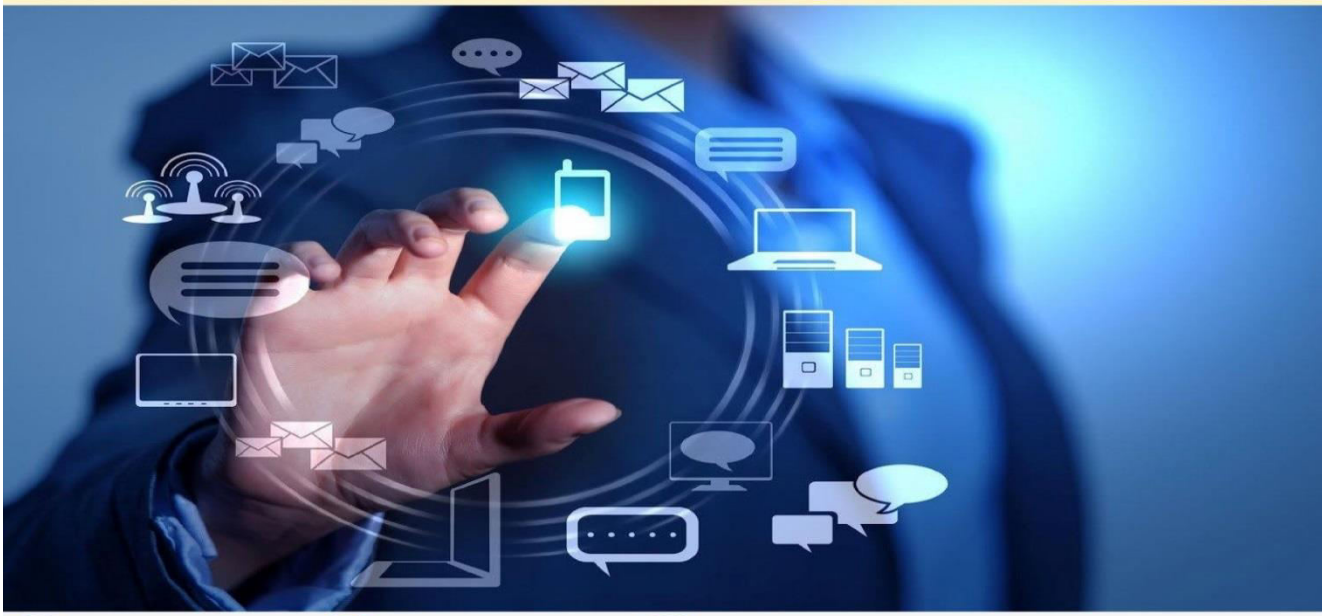
Total:	**50**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Learned and Solved different types of display techniques.. CO2: WAP for Point, Line, Circle, Ellipse, Polygon algorithm. CO3: Learned and Solved 2DTransformations and Composition of 3-D Transformation. CO4: Applied Point ,Text, Line, Polygon Clipping and Cohen-Sutherland Clipping Algorithm CO5: Learned and Solved Pipeline and Different Types of Projections techniques.	

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SCHOOL OF COMPUTER SCIENCE & APPLICATIONS

ACADEMIC HAND BOOK



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Ordinance & Academic Regulations
For Master of Computer Applications (MCA)
(Established by Govt. of U.P. Vide U.P act No.32 of 2016)
(Academic Session: 2025-26)

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DEFINITIONS AND NOMEN CLATURE:

(i) "**Programme**" means Post Graduate Degree Programme like Master of Computer Application (MCA). Hence, further MCA and MCA (AI & ML) will call MCA in this document. AI means Artificial Intelligence and ML means Machine Learning.

(ii) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.

(iii) **Semester:** Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from **July to December** and even semester from **January to June**.

(iv) **Program:** An educational program leading to award of a degree.

(v) "**VC**, Vice-Chancellor of IIMT-University" means the Head of the University.

(vi) **Course:** Usually referred to, as 'papers' is a component of a program. All courses need not carry the same weightage. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/tutorials/laboratory work/field work / outreach activities / project work / vocational training / viva / seminars / term papers / assignments / presentations / self-study etc. or a combination of some of these.

(vii) **Branch:** Master of Computer Applications (MCA).

(viii) **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters A, B, C, D, E and F.

(ix) **Grade Point:** It is a numerical weightage allotted to each letter grade on a 10-pointscale.

(x) **Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

(xi) **Credit Point:** It is the product of grade point and number of credits for a course.

(xii) **Semester Grade Point Average (SGPA):** It is a measure of academic performance of student/s in a semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

(xiii) **Cumulative Grade Point Average (CGPA):** It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points earned by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

(xiv) **First Attempt:** If a student has completed all formalities and become eligible to attend the examinations and has attended at least one subject of passing, such attempt (first sitting) shall be considered as first attempt.

(xv) **Transcript or Grade Card or Certificate:** Based on the grades earned, a grade sheet/certificate shall be issued to all the registered students at the end of every academic year. The grade sheet/certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of both semesters and CGPA earned till that academic year.

(xvi) **UGC:** University Grants Commission.

(xvii) **AIU:** Association of Indian universities

The CBCS provides choice for students to select from the prescribed courses. Sequencing Plan for the **MCA** Post Graduate Degree Curriculum

Semesters Course Coverage

I–II Foundation Course for Computer Applications and Programming Techniques, Mathematical Foundations, Numerical & Statistical Techniques and Course on Computer Organizations and Entrepreneurial Skills etc.

III-IV Core Courses including Design & Development of Applications, Design& Analysis of Algorithms, Operating Systems, Applications of Information Systems, Web Application Development, Artificial Intelligence, Elective Coursesand Mini Project Work etc.

1. PREAMBLE

As the technological enhancement and availability of technology to every person of world a huge demand of computer skilled professional is ample. In this world of opportunities, impact of higher education is so inevitable for getting desired guidance to secure, right kind of employment. It is compulsory to pursue higher related- education in the best institutes. The syllabus development is a step to ensure development of the undergraduates for both, academia and employability. Latest technical trends, industry standards, market needs, and interests of students, future expectations the need has been taken into consideration while developing the syllabus.

This is an effort to develop a student centric framework where they are expected to have a concrete understanding of fundamentals of computer science along with the latest trends and techniques like Artificial Intelligence, Internet of Things (IoT), Machine Learning (ML) with advanced skill sets that include Mobile Application environment, Object Oriented Programming (OOPs) among many courses. Each course aims to present learning targets and objectives, and thus provide learning and teaching strategies, assessment and resources. The students shall be equipped with the latest trends in computer science, after completion of the programme.

With this an education temple of nation should ensure an environment, which should be bias free, irrespective of cast, religion, races, sex difference and easily available to youths of the nation. The human value, ethics and environmental teaching is also introduced with this.

2. VISION AND MISSION OF THE SCHOOL

VISION

To achieve heights in computer education domain by creating appropriate environment for students, faculties and staff with availability of latest technological infrastructure.

MISSION

1. To dissipate appropriate all types of practical and theoretical computer science knowledge to our young students.
2. Inculcate professional efficiency in the students for brighter career opportunity as per industry latest requirement.
3. To provide learning environment for students with our reputed academics partner in the field of computer science.
4. To prepare our student as an IT professional with full of ethics and human values.

3. PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: The Postgraduates Programs are designated to produce skilled Postgraduates who will be proficient professionals in private sector, semi government and government institutions.

PEO2: The pass out Postgraduates will be able to handle the overall world requirements and will become effective employees or employers.

PEO3: The pass out Postgraduates will be a good team leader and will be able to lead the team to find inexpensive and optimal solutions and, achieve expertise in their fields or become entrepreneurs and play the proficiently managing roles in all types of institutions, establishment, and industry ventures.

4. PROGRAM OUTCOMES (PO'S)

PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1: The Postgraduates are capable in basic principles and methods of Computer era with sufficient Mathematical and Scientific grounds and can:

- Apply fundamental concepts of integration, Artificial intelligence with deep learning, differentiation, vector calculus, probability & statistics, and discrete mathematics.
- Design, create & evaluate programming algorithms appropriate to all types of current real frequent changing difficulties.

PSO2: The Postgraduates have deep sense acknowledgement for:

- Present capability for computers, computer network and server environments and their troubleshooting.
- Capacity to handle ever changing cloud computing environments and related solutions.
- Well defined knowledge for solving problems of security and threats in knowledge and financial domain.

6. ADMISSION

6.1 Admission to MCA first year in Ist Semester.

6.2 Admission on migration of a candidate from any other University to the University is not permitted.

7. ELIGIBILITY FORADMISSIONS

7.1 **Admission to MCA First Year:**
For admission to first year of MCA in IIMT University, Meerut, a candidate must have passed Bachelor degree course of 03 Years minimum duration from any recognized Indian University; or its equivalent, recognized by **A.I.U.** securing minimum 50% (45% for SC/ST) marks in aggregate. Candidate must have passed Mathematics at 10+2 level or Graduation level.

7.2 The Academic Council shall have power to amend or repeal the eligibility criteria laid down at clause 7.1 as per the guidelines of AICTE.

8. ATTENDANCE

8.1 Every student is required to attend all the Lectures, Tutorials, Practical Classes and other prescribed curricular and co-curricular activities. The attendance can be condoned up to 25% on medical grounds or for other genuine reasons beyond the control of students.

8.2 A further relaxation of attendance up to 15% for a student can be given by Head of School/College provided that he/she has been absent with prior permission of the Head of the School/college for the reasons acceptable to him.

8.3 No student will be allowed to appear in the end semester examination if he / she do not satisfy the overall average attendance requirements of Clause Nos. 8.1, and 8.2. Such candidate(s) shall be treated as having failed and will be further governed by clause no. 9.2 &9.3.

8.4 The attendance shall be counted from the date of admission in the college or start of academic session whichever is later.

9. DURATION OFCOURSE

9.1 Total duration of the MCA Course shall be 2 years, each year comprising two semesters. Each semester shall normally have teaching for the 90 working days or as prescribed by A.I.C.T.E. from time to time.

9.2 The student admitted to 1st year MCA Course shall complete the course within a period of five (05 Years) Academic Years from the date of first admission, failing which he/she has to discontinue the course.

9.3 A Student, who has failed twice in first year due to any reason (either due to his/her non-appearance or he/she being not permitted to appear in semester examinations) shall not be allowed to continue his/her studies further. Provided further that if a student wishes to continue third time in first year, he/she may be allowed on the terms and conditions laid down by the University for such permission but the maximum time allowed for completing the course will remain the same as described in clause 4.2.

9.4 The minimum percentage requirement for MCA Degree is 40%.

10. %CURRICULUM

10.1 The 2 Year curriculum has been divided into 4Semesters and shall include Lectures, Tutorials, Practical Labs, Seminars and Projects etc. in addition to industrial training as defined in the scheme and executive instructions issued by the University from time to time.

10.2 The curriculum will also include other curricular, co-curricular and extracurricular activities as may be prescribed by the University from time to time.

10.3 The subjects listed in semester I or II for MCA will be as per Course Structure of MCA Program and shall not be offered exactly in the same sequence.

11. EXAMINATION

11.1 The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/tutorials, quizzes/viva-voce and attendance. The marks for continuous assessment (Sessional marks) shall be awarded at the end of the semester. The end semester examination shall be comprised of written papers, Practical and Viva-voce, Record of Lab Work, Project Work, Design Reports or by means of any combination of these methods.

11.2 The distribution of marks for sessional, end semester theory papers, practical and other examinations, seminar, project and industrial training shall be as prescribed by the University in prescribed Course Structure. The practical, viva-voce, projects and reports shall be examined/evaluated through internal and external examiners as and when required, as per university guidelines.

11.3 The marks obtained in a subject shall consist of marks allotted in end semester theory paper and sessional work.

12. ELIGIBILITY OFPASSING

12.1 A student who obtained Grades $A^{+}$to E shall be considered as passed. If a student secured "F" grade, he /she has to reappear for the examination**.** It is mandatory for a student to earn the required credits as mentioned in each semester.

(a) For a pass in a Theory Subject, a student shall secure minimum of 30% of the maximum marks prescribed in the University Examination and 40% of marks in the aggregate marks in the subject including sessional marks. i.e., Minimum Passing Grade is "E".

(b) For a pass in a Practical/Project/Viva-voce examination, a student shall secure a minimum of 50% of the maximum marks prescribed for the University Examination in the relevant Practical/Project/Viva-voce and 40% of marks in the aggregate marks in the Practical/Project/Viva-voce including sessional marks i.e., Minimum Passing Grade in a course is "E".

12.2 The students who do not satisfy the condition 12.1 or the student who remains absent shall be deemed to have failed in that subject and may reappear for the University examination in the subsequent examinations. However, the Sessional marks awarded to the student/s at previous attempt in the concerned subject will be carried forward.

12.3 A student may, at his/her desire, opt to abandon his/her performance of a semester in following manner.

(a) A student may opt to abandon his/her performance only in University Examination of the Semester.

(b) A student may opt to abandon his/her Total Performance of the Semester which includes performance in University Examination and Sessional Marks.

(c) A student may opt to abandon his/her performance in University Examination of any or both semesters of the same academic year only.

(d) A student shall be allowed to abandon the performance maximum twice during the entire course of study.

(e) Performance of a semester, once abandoned, cannot be claimed again.

12.4 The student, who opts to abandon the performance of a semester as per clause 12.3, shall abandon performance in all the courses of that semester, irrespective of the fact whether the student has passed or failed in any subject of that semester.

12.5 A student, who opts to abandon the total performance of the semester including sessional marks, has to take readmission for the relevant semester. Readmission to the First semester in such cases shall not be considered as fresh admission i.e., the student will continue to have the same University Roll Number, which was allotted earlier.

12.6 The student, who opted to abandon his / her performance only in the University examination of a semester and does not desire readmission, shall be permitted to re-appear for examinations of all the subjects of the semester in the subsequent examinations as an Ex- Student. However, the sessional marks obtained by the student in the abandoned semester shall be retained.

12.7 Such students who opted to abandon the performance at final year are eligible for the award of Class and Distinction at the MCA degree level, but are not eligible for the award of ranks.

12.8 The student who passes a course of a semester as per 12.1 shall not be allowed to appear for the same again, unless he/she opts for *abandoning of results* as per12.3-12.7.

12.9 A student shall be declared to have completed the program of MCA degree, provided the student has undergone the stipulated course work as per the regulations and has overall 40 percent marks.

13. ELIGIBILITYFORPROMOTION

13.1 There shall not be any restriction for promotion from an odd semester to the next even semester.

13.2 For promotion from even semester to the next odd semester (i.e., of the next academic year) the student has cleared in at least seven subjects in the immediately preceding two semesters including theory and practical exam.

13.3 The result of the semester shall be declared pass only on securing E or above grades in all subjects and minimum Semester Grade Point Average (SGPA) is 5.0.

13.4 Student himself can decide to abandon the performance of any or both the semesters of same academic year as per clause 8.3 and reappear in abandoned semester examination as per clauses 7.4, 7.5 &7.6.

13.5 Grace Marks:

13.5.1 A candidate may be awarded grace marks a maximum of total 10 marks distributed in maximum four subjects, not more than 5 marks in an individual subject, including theory papers, practical, seminar, project and/or aggregate marks in each academic year provided he/she can be declared to have passed the academic year by the award of these marks.

13.5.2 The grace marks shall not be added to the aggregate marks.

14. CARRYOVERSYSTEM

14.1 Following rules shall be followed for carry over papers:

(a) A candidate who satisfies the requirements of clause 12.2 (a) will be required to appear in those theory papers / practical's during respective end semester exams in which he/she failed.
(b) A candidate satisfying clause 12.2 (b) shall be required to exercise his/her choice of theory papers in which he/she desires to appear in the examination to fulfill the requirements of clause12.1(a).
(c) A candidate shall be required to exercise his/her choice of minimum theory papers in which he/she desires to appear in the examination for improvement to fulfill the requirements of clause13.3.
(d) Candidate appearing for carry over paper in any semester shall be examined with the examination paper of that subject running in that semester.

14.2 All carryover examinations shall be held only with end semester examination.

15. RE-ADMISSION IN THE SCHOOL/ COLLEGE

A candidate may be allowed for re-admission provided he/she satisfies one of the following conditions:

(a) A candidate is declared fail.

(b) A candidate did not appear in a semester examination / or he/she was not granted permission to appear in the examination.

(c) A candidate has been detained by the institute and subsequently has been permitted to takere-admission.

(d) A candidate has own desire to abandon the performance of semester(s).

16. COMPUTATION OF SGPA ANDCGPA

16.1 The IIMT University Meerut adopts absolute grading system wherein the marks are converted to grades, and every semester results will be declared with semester grade point average (SGPA) and Cumulative Grade Point Average (CGPA). The CGPA will be calculated every semester, except the first semester. The grading system is with the following letter grades and grade points scale as given below:

Level	Out standing	Excellent	Very Good	Good	Above Average	Average	Poor	Fail
Letter Grade	A+	A	B+	B	C	D	E	F
Grade Points	10	9	8	7	6	5	4	00
Score (Marks) Range (%)	≥ 90 (90-100)	<90 (80-89)	<80, ≥70 (70-79)	<70, ≥60 (60-69)	<60 ≥50 (50-59)	<50, ≥45 (45-49)	<45, ≥40 (40-44)	< 40 (0-39)

16.2 A student obtaining Grade "F" shall be considered failed and will be required to reappear in the examination. Such students after passing the failed subject in subsequent examination/s will be awarded with "E" grade irrespective of marks he/she scores in the subsequent examination/s. Number of attempts taken to clear a subject/s shall be shown in the transcripts.

16.3 The University has right to scale/moderate the theory exam/practical exam/sessional marks of any subject whenever required for converting of marks in to letter grades on the basis of the result statistics of university as in usual practice.

(a) The modality for moderation of marks before the declaration of result shall be decided by a committee of Pro-Vice Chancellor, Dean UG, Assoc. Dean UG and Controller of Examination.

(b) The modality for moderation of marks if needed after the declaration of result shall be decided by a committee of Pro-Vice Chancellor, Dean UG, Assoc. Dean UG, Controller of Examination and an external member not below the rank of Professor nominated by the Vice Chancellor.

(c) If the candidate(s) appeared in the examination but theory marks are not available due to missing of copy by any reason, the average marks may be awarded as decided by the committee mentioned in 16.3(a). In case of missing/unavailable of sessional marks, Controller of Examination can take decision as per the provision laid down by the Examination Committee.

(d) The Committee defined in16.3 (a) shall also fix up the responsibility and recommend the punishment for occurrence of such case(s) in 16.3 (c).

(e) All the matters defined under 15.3(a) to 15.3 (d) shall be executed subject to the approval of Academic Council of the IIMTU.

16.4 Computation of SGPA and CGPA

The following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

(a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA\ (S_i) = \Sigma(C_i \times G_i) / \Sigma C_i$$

Where C_i is the number of credits of the **i^{th}**course and Gi is the grade point scored by the student in the **i^{th}**course.

(b) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$\mathbf{CGPA} = \Sigma\ (C_i \times S_i) / \Sigma\ C_i$$

where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

(c) The SGPA and CGPA shall be rounded off to 2 decimal places and reported in the transcripts.

Illustration for Computation of SGPA and CGPA Computation of SGPA Illustration No.1

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	**4**	**B^+**	**8**	4x8 = 32
Course 2	**4**	**C**	**6**	4x6 = 24
Course 3	**4**	**B**	**7**	4x7 = 28
Course 4	**3**	**A+**	**10**	3x10= 30
Course 5	**3**	**D**	**4**	3x4 = 12
Course 6	**2**	**C**	**6**	2x6 = 12
Course 7	**2**	**A**	**9**	2x9 = 18
Course 8	**2**	**C**	**6**	2x6 = 12
Total	**24**			**168**

Thus, **SGPA= 168/24=7.00**

Illustration No.2

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	**4**	**B+**	**8**	4x8 = 32
Course 2	**4**	**C**	**6**	4x6 = 24
Course 3	**4**	**B**	**7**	4x7 = 28
Course 4	**3**	**A+**	**10**	3x10= 30
Course 5	**3**	**F**	**0**	3x0= 00
Course 6	**2**	**C**	**6**	2x6 = 12
Course 7	**2**	**A**	**9**	2x9 = 18
Course 8	**2**	**C**	**6**	2x6 = 12
Total	**24**			**156**

Thus, **SGPA= 156/24=6.50**
Illustration No.2 (a)

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade)
Course 1	**3**	**E**	**4**	3x4 = 12

C_i (First Attempt) 156+C_i (subsequent attempt)12= 168
Thus, **SGPA= 168/24=7.00**
Illustration No.3

Course	Credit	Grade letter	Grade point	CreditPoint (Credit x Grade)
Course 1	**4**	**B+**	**8**	4x8 = 32
Course 2	**4**	**C**	**6**	4x6 = 24
Course 3	**4**	**B**	**7**	4x7 = 28
Course 4	**3**	**A+**	**10**	3x10= 30
Course 5	**3**	**A**	**9**	3x9= 27
Course 6	**2**	**C**	**6**	2x6 = 12
Course 7	**2**	**A**	**9**	2x9 = 18
Course 8	**2**	**C**	**6**	2x6 = 12
Total	**24**			**183**

Thus, **SGPA= 183/24=7.63**
CGPA= 24x7.00+24x7.63/48=7.3125
CGPA after Final Semester

Sem.- 1	Sem. - 2	Sem. - 3	Sem. – 4
Credit: 24	Credit: 24	Credit: 27	Credit: 27
SGPA:7	SGPA:8.5	SGPA:9.2	SGPA:6.86

Thus, **CGPA**=24*x*7 + 24*x*8.5 + 27*x*9.2 + 27*x*6.86 + 24*x*8.18 + 24*x*7.73 **=7.92**

16.5 **Transcript (Format):** Based on the above recommendations on Lettergrades, grade points, SGPA and CCPA, the transcript for eachsemester and a consolidated transcript indicating the performance inall semesters may beissued.

17. CONVERSION OF GRADES INTOPERCENTAGE
Conversion formula for the conversion of CGPA into Percentage is

CGPA Earned x 10= Percentage of marks scored.
Illustration: CGPA Earned 7.92 x 10 = 79.2%

18. AWARD OF DIVISION, RANKANDMEDALS

18.1 Division shall be awarded only after the final semester examination based on integrated performance of the candidate for all the six semesters (four semesters for lateral entry) as per following details.

(a) A candidate who qualifies for the award of the degree securing E or above grades in all subjects pertaining to all semesters in his/her first attempt within six consecutive semesters (three academic years)/ four consecutive semesters (two academic years) as applicable, and in addition secures a CGPA of 7.5 and above for the semesters I to VI and in case of lateral entry (III to VI) shall be declared to have passed the examination in FIRST DIVISION WITHHONOURS.

(b) A candidate who qualifies for the award of the degree by securing E or above grades in all subjects of all the semesters within a maximum period of six semesters/four semesters as applicable, after his/her commencement of study in the 1st/3rd semester and secures CGPA not less than 6.5 shall be declared to have passed the examination in **FIRST DIVISION**.

(c) All other candidates who qualify for the award of degree by securing E or above grades in all subjects of all semesters within a maximum period of six / four semesters as applicable, after his/her commencement of study in the 1st/3rdsemester an addition secures CGPA not less than 5.0 shall be declared to have passed the examination in **SECOND DIVISION**.

18.2 For award of ranks a minimum of 10 students should have appeared in the 4th semester examination. The total number of ranks awarded shall be 10% of total number of students appeared in 6th semester or 10 students, whichever is less.

Illustration:

1. If 100 students appeared for the 4th semester in MCA, the number of ranks to be awarded for MCA will be 10.
2. If 90 students appeared for the 4th semester in MCA, the number of ranks to be awarded for MCA will be 09.

For award of rank in MCA, the CGPA secured by the student from

(a) 1stto 6th semester for the students admitted to MCA. Program from 1st year, And A student shall be eligible for a rank at the time of award of degree in MCA, provided the student.

(b) Has passed 1stto 4th (students joining from 1stsemester) semester in all the subjects in first attempt only.

(a) Has not repeated/rejected any of the lower semesters.

If two students get the same *CGPA*, the tie should be resolved by considering the number of times a student has obtained higher *SGPA;* but, if it is not resolved even at this stage, the number of times a student has obtained higher grades like A^+, A, B^+, B etc. shall be taken into account in rank ordering of the students in a program.

18.3 The Gold, Silver and any other Medals as decided by the university shall be awarded to student's falls in the top ranks of various courses as per university rules.

19. SCRUTINY ANDREVALUATION

19.1 Scrutiny shall be allowed in only theory papers.

19.2 Revaluation of theory/practical papers is permitted only with certain conditions as laid down by university.

20. UNFAIRMEANS

Cases of unfair means shall be dealt as per the rules and regulations of the University.

21. AWARD OF SESSIONALMARKS

Sessional marks for theory subjects, practical and project shall be awarded as prescribed and at present the break-up of sessional marks shall be as follows:

(a) Theory Subjects:

(i) Class test which will comprise 20 % of total theory marks with two mid-term tests of equal weightage.

(ii) Teacher Assessment Tutorial/Assignment/ Quizzes/ Attendance comprises 10% of total theory marks.

(b) Practical:

(i) Two mid-term viva-voce/tests of equal weightage 30%of total Practical marks.

(ii) Teacher Assessment: Lab, Record/ Attendance 20%of total Practical marks.

(c) **Make-up test** may be held only for those students who could not appear in any one of mid-term class tests due to genuine reasons for which the prior permission from the Head of Institution/College was taken. Make up test shall ordinarily be held about two weeks before the semester examination. The syllabus for the make-up test shall be the whole syllabus covered by the subject teacher up to that time.

22. AWARD OF SEMINAR INDUSTRIAL TRAINING, EDUCATIONAL TOUR MARKS AT INSTITUTION/COLLEGELEVEL

22.1 The marks of Seminar, Industrial Training, Educational tour marks shall be awarded on the following basis:

(a) Write-up / Report 50%

(b) Presentation 50%

22.2 The marks in Seminar, Industrial Training and Educational Tour shall be awarded by a committee consisting of following members:

(a) Head of the Department or his/her nominee.

(b) Concerned Officer – In-charge.

(c) Senior Faculty Member of the department nominated by the Head of Department.

23. CANCELLATION OFADMISSION

The admission of a student at any stage of study shall be cancelled if:

(i) He / She is not found qualified as per AICTE / State Government norms and guidelines or the eligibility criteria prescribed by the University. Or

(ii) He / She is found unable to complete the course within the stipulated time as prescribed in clause 4.2or

(iii) He / She are found involved in creating indiscipline in the Institution / College or in the University.

24. STUDENT DESCIPILINE

Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige reputation of the University and School.

25. RAGGING

Ragging in any form is a criminal and non-bail able offence in our country. The current State and Central legislations provide stringent punishments including imprisonment. Once the involvement of a student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the University, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student at the University, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

26. POWER TO MODIFY

Not-withstanding all that has been stated above, the Academic Council is vested with powers to modify any or all the above regulations from time to time, if required, subject to the approval by the Board of Studies and final approval by Vice-Chancellor.

IIMT UNIVERSITY MEERUT
Transforming Education System, Transforming Lives
UGC Approved Section 2(f) & 12B
NAAC Accredited with A GRADE

Evaluation Scheme

MCA (MASTER OF COMPUTER APPLICATION)
Year: I / Semester: I

S. No.	Subject Code	Subject Name	Course Type	Periods			Internal	External	Total	Credit
				L	T	P				
1.	MCA-111	Fundamental of Computers & Emerging Technologies	Core Theory	3	1	0	30	70	100	4
2.	MCA-112	Problem Solving using C	Core Theory	3	1	0	30	70	100	4
3.	MCA-113	Principles of Management &Communication	DSE	4	0	0	30	70	100	4
4.	MCA-114	Discrete Mathematics	DSE	4	0	0	30	70	100	4
5.	MCA-115	Computer Organization &Architecture	Core Theory	3	1	0	30	70	100	4
6.	MCA-116P	Problem Solving using C Lab	Core Practical	0	0	4	20	30	50	2
7.	MCA-117P	Computer Organization & Architecture Lab	Core Practical	0	0	4	20	30	50	2
8.	MCA-P1	Mini Project lab	Skill Enhancement Course	0	0	4	20	30	50	2
9.	ECC-111	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	0	0	25	0
10	ECC-112	University Social Responsibility	Skill Enhancement Course	0	0	0	0	0	25	0
11		Sports	Audit Course	0	0	0	50	0	50	0
		Total		**17**	**3**	**12**	**210**	**440**	**650**	**26**

MCA (MASTER OF COMPUTER APPLICATION
Year: I / Semester: II

S. No.	Subject Code	Subject Name	Course Type	Periods			Internal	External	Total	Credit
				L	T	P				
1.	MCA-121	Theory of Automata & Formal Languages	DSE	4	0	0	30	70	100	4
2.	MCA-122	Object Oriented Programming	Core Theory	3	1	0	30	70	100	4
3.	MCA-123	Operating Systems	Core Theory	3	1	0	30	70	100	4
4.	MCA-124	Database Management Systems	Core Theory	3	1	0	30	70	100	4
5.	MCA-125	Data Structures & Analysis of Algorithms	DSE	4	0	0	30	70	100	4
7.	MCA-126P	Object Oriented Programming Lab	Core Practical	0	0	4	20	30	50	2
8.	MCA-127P	DBMS LAB	Core Practical	0	0	4	20	30	50	2
9.	MCA-P2	Mini Project Lab	Skill Enhancement Course	0	0	4	20	30	50	2
10.	ECC-121	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	0	0	25	0
11.	ECC-122	University Social Responsibility	Skill Enhancement Course	0	0	0	0	0	25	0
12.		Sports	Audit Course	0	0	0	50	0	50	0
		Total		**17**	**3**	**12**	**210**	**440**	**650**	**26**

MCA (MASTER OF COMPUTER APPLICATION)
Year: II / Semester: III

S. No.	Subject Code	Subject Name	Course Type	Periods			Internal	External	Total	Credit
				L	T	P				
1.	MCA-231	Artificial Intelligence	Core Theory	3	1	0	30	70	100	4
2.	MCA-232	Software Engineering	Core Theory	3	1	0	30	70	100	4
3.	MCA-233	Computer Network	DSE	4	0	0	30	70	100	4
4.		Elective – 1	DSE	4	0	0	30	70	100	4
5.		Elective – 2	Core Theory	3	1	0	30	70	100	4
6.	MCA-231P	Artificial Intelligence Lab	Core Practical	0	0	4	20	30	50	2
7.	MCA-232P	Software Engineering Lab	Core Practical	0	0	4	20	30	50	2
8.	MCA-P3	Mini Project lab	Skill Enhancement Course	0	0	4	20	30	50	2
9.	ECC-111	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	0	0	25	0
10	ECC-112	University Social Responsibility	Skill Enhancement Course	0	0	0	0	0	25	0
11		Sports	Audit Course	0	0	0	50	0	50	0
		Total		**17**	**3**	**12**	**210**	**440**	**650**	**26**

Elective-1	MCA011	Cryptography & Network Security	**Elective-2**	MCA021	Web Technology
	MCA012	Data Warehousing & Data Mining		MCA022	Big Data
	MCA013	Software Project Management		MCA023	Simulation & Modeling
	MCA014	Cloud Computing		MCA024	Software Testing & Quality Assurance
	MCA015	Compiler Design		MCA025	Digital Image Processing

MCA (MASTER OF COMPUTER APPLICATION)
Year-II / Semester-IV

S. No.	Subject Code	Subject Name	Course Type	Periods			Internal	External	Total	Credit
				L	T	P				
1.		Elective – 3	3	0	0	30	20	50	100	3
2.		Elective – 4	3	0	0	30	20	50	100	3
3.		Elective – 5	3	0	0	30	20	50	100	3
4.	MCA-451	Project	-	-	-	-	200	200	500	14
		Total							1050	**23**

Elective-3	MCA031	Privacy & Security in Online social media	**Elective-4**	MCA041	Block chain Architecture
	MCA032	Soft Computing		MCA042	Neural Network
	MCA033	Pattern Recognition		MCA043	Internet of Things
	MCA034	Data Analytics		MCA044	Modern Application Development
	MCA035	Software Quality Engineering		MCA045	Distributed Database Systems
Elective-5	MCA051	Mobile Computing			
	MCA052	Computer Graphics and Animation			
	MCA053	Natural Language Processing			
	MCA054	Machine Learning			
	MCA055	Quantum Computing			

Format-3

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Fundamental of Computers & Emerging Technologies**
Course Code: MCA - 111	**Title: Fundamental of Computers & Emerging Technologies**

Course Objectives:
CO1 Demonstrate the knowledge of the basic structure, components, features and generations of computers.
CO2: Describe the concept of computer languages, language translators and construct algorithms to solve problems using programming concepts.
CO3: Compare and contrast features, functioning & types of operating system and computer networks.
CO4: Demonstrate architecture, functioning & services of the Internet and basics of multimedia.
CO5: Illustrate the emerging trends and technologies in the field of Information Technology.

Nature of Paper: CORE COURSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Computer:** Definition, Computer Hardware & Computer Software **Components:** Hardware–Introduction, Input devices, Output devices, Central Processing Unit, Memory-Primary and Secondary. Software-Introduction, Types–System and Application. **Computer Languages:** Introduction, Concept of Compiler, Interpreter & Assembler. **Problem solving concept:** Algorithms–Introduction, Definition, Characteristics, Limitations, Conditions in pseudo-code, Loops in pseudo code.	8
II	**Operating system:** Definition, Functions, Types, Classification, Elements of command based and GUI based operating system. **Computer Network:** Overview, Types (LAN, WAN and MAN), Data communication, topologies.	8
III	**Internet:** Overview, Architecture, Functioning, Basic services like WWW, FTP, Telnet, Gopher etc., Search engines, E-mail, Web Browsers. **Internet of Things (IoT):** Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.	8

IV	**Block chain:** Introduction, overview, features, limitations and application areas fundamentals of Block Chain. **Crypto currencies:** Introduction, Applications and use cases. **Cloud Computing:** It nature and benefits, AWS, Google, Microsoft & IBM Services	8
V	**Emerging Technologies:** Introduction, over view, features, limitations and application areas of Augmented Reality, Virtual Reality, Grid computing, Green computing, Big data analytics, Quantum Computing and Brain Computer Interface.	8

Text Books:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
2. Norton P., "Introduction to Computers", Mc Graw Hill Education.
3. Goel A., "Computer Fundamentals", Pearson.

Reference

1. Balagurusamy E., "Fundamentals of Computers", McGraw Hill.
2. Thareja R., "Fundamentals of Computers", Oxford University Press.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Demonstrate the use of mathematical software and solve simple mathematical problems.
CO2: Explain the needs of hardware and software required for a computation task.
CO3: State typical provisions of cyber law that govern the proper usage of Internet and computing resources.
CO4: Explain the working of important application software and their use to perform any engineering activity.
CO5: Demonstrate the use of Operating system commands and shell script.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: PROBLEM SOLVING USING C**
Course Code: MCA - 112	**Title: PROBLEM SOLVING USING C**

Course Objectives:

CO1: Describe the functional components and fundamental concepts of a digital computer system including number systems.
CO2: Construct flow chart and write algorithms for solving basic problems.
CO3: Write simple programs using the basic elements like control statements, functions, arrays and strings.
CO4: Write advanced programs using the concepts of pointers, structures, unions and enumerated data types.
CO5: Apply pre-processor directives and basic file handling and graphics operations in advanced programming.

Nature of Paper: CORE COURSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Basics of programming:** Approaches to problem solving, Use of high-level programming language for systematic development of programs, Concept of algorithm and flow chart, Concept and role of structured programming. **Basics of C**: History of C, Salient features of C, Structure of C Program, Compiling C Program, Link and Run C Program, Character set, Tokens, Keywords, Identifiers, Constants, Variables, Instructions, Data types, Standard Input / Output, Operators and expressions.	8
II	**Conditional Program Execution:** if, if-else, and nested if-else statements, Switch statements, Restrictions on switch values, Use of break and default with switch, Comparison of switch and if-else. **Loops and Iteration:** for, while and do-while loops, Multi ple loop variables, Nested loops, Assignment operators, break and continue statement. **Functions:** Introduction, Types, Declaration of a Function, Function calls, defining functions, Function Proto types, Passing arguments to a Function Return values and their types, writing multi-function program, Calling function by value, Recursive	8

	functions.	
III	**Arrays:** Array notation and representation, Declaring one-dimensional array, Initializing arrays, Accessing array elements, Manipulating array elements, Arrays of unknown or varying size, Two-dimensional arrays, Multi-dimensional arrays. **Pointers:** Introduction, Characteristics, *and & operators, Pointer type declaration and assignment, Pointer arithmetic, Call by reference, Passing pointers to functions, array of pointers, Pointers to functions, Pointer to pointer, Array of pointers. **Strings:** Introduction, Initializing strings, Accessing string elements, Array of strings, Passing strings to functions, String functions.	8
IV	**Structure:** Introduction, Initializing, defining and declaring structure, Accessing members, Operations on individual members, Operations on structures, Structure within structure, Array of structure, Pointers to structure. **Union:** Introduction, Declaring union, Usage of unions, Operations on union. Enumerated data types **Storage classes**: Introduction, Types- automatic, register, static and external.	8
V	**Dynamic Memory Allocation**: Introduction, Library functions–malloc, calloc, realloc and free. **File Handling:** Basics, File types, File operations, File pointer, File opening modes, File handling functions, File handling through command line argument, Record I/O in files. **Graphics:** Introduction, Constant, Data types and global variables used in graphics, Library functions used in drawing, Drawing and filling images, GUI interaction within the program.	8

Text Books:

1. Kanetkar Y., "Let Us C", BPB Publications.
2. Hanly J. R. and Koffman E. B., "Problem Solving and Program Design in C", Pearson Education.
3. Schildt H., "C- The Complete Reference", Mc Graw-Hill.

Reference

1. Goyal K.K. and Pandey H.M., Trouble Free C", University Science Press.
2. Gottfried B., "Schaum's Outlines-Programming in C", McGraw-Hill Publications.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	20
4) Research Project Report/ Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL
Course Learning Outcomes: CO1: Students will be able to develop programs based on fundamental concepts of programming in C. CO2: Students will be able to solve problems based on Conditional and Iterative Control Statements. CO3: Students will be able to learn Complete Programming Concepts of Arrays, Pointers and get familiar with modular programming Concepts of C using Functions. CO4: Students will be able to learn conceptual programming with String, Structure and its differentiation with Union. CO5: Students will be able to perform File handling programs with read and write concepts.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Principles of Management & Communication**
Course Code: MCA - 113	**Title: Principles of Management & Communication**

Course Objectives:
CO1: Describe primary features, processes and principles of management.
CO2: Explain functions of management in terms of planning, decision making and organizing.
CO3: Illustrate key factors of leadership skill in directing and controlling business resources and processes.
CO4: Exhibited quat ever bal and non-verbal communication skills.
CO5: Demonstrate effective discussion, presentation and writing skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Management**: Need, Scope, Meaning and Definition. The process of Management, Development of Management thought F.W. Taylor and Henry Fayol, Horothorne Studies, Qualities of an Efficient Management.	8
II	**Planning & Organising:** Need, Scope and Importance of Planning, Steps in planning, Decision making model. Organising need and Importance, Organisational Design, Organisational structure, centralization and Decentralisation, Delegations.	8
III	**Directing & Controlling:** Motivation—Meaning, Importance, need. Theories of Motivation, Leadership—meaning, need and importance, leadership style, Qualities of effective leader, principles of directing, Basic control process, Different control Techniques.	8
IV	**Introduction to Communication:** What is Communication, Levels of communication, Barriers to communication, Process of Communication, Non-verbal Communication, The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group) Communication, Technology Enabled communication, Impact of Technology, Selection of appropriate communication Technology, Importance of Technical communication.	8
V	**Business letters:** Sales & Credit letters; Claim and Adjustment Letters; Job application and Resumes. **Reports:** Types; Structure, Style & Writing of Reports.	8

	Technical Proposal: Parts; Types; Writing of Proposal; Significance. Nuances of Delivery; Body Language; Dimensions of Speech: Syllable; Accent; Pitch; Rhythm; Intonation; Paralinguistic features of voice; Communication skills, Presentation strategies, Group Discussion; Interview skills; Workshop; Conference; Seminars.	

Text Books:

1. P.C. Tripathi, P.N. Reddy, "Principles of Management", Mc Graw Hill Education 6th Edition.
2. C.B. Gupta, "Management Principles and Practice", Sultan Chand & Sons 3rd edition.
3. T.N. Chhabra, "Business Communication", Sun India Publication.

Reference

1. V.N. Aroraand Laxmi Chandra, "Improve Your Writing", Oxford Univ. Press, 2001, New Delhi.
2. Madhu Rani and Seema Verma, "Technical Communication: A Practical Approach", Acme Learning, New Delhi-2011.

Evaluation/Assessment Methodology

	Max. Marks :100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Identify different concept of management.
CO2: Able to understand the importance of planning and orgaising.
CO3: Able to explore communication beyond language.
CO4: Able to manage one-self while communicating.
CO5: Able to acquire good communication skills and develop confidence.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Discrete Mathematics**
Course Code: MCA - 114	**Title: Discrete Mathematics**

Course Objectives:

CO1: Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions.
CO2: Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and pro positional and predicate logic.
CO3: Identify and prove properties of Algebraic Structures like Groups, Rings and Fields.
CO4: Formulate and solve recurrences and recursive functions.
CO5: Demonstrate effective discussion, presentation and writing skills.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Set Theory:** Introduction, Size of sets and Cardinals, Venn diagrams, Combination of sets, Multi sets, ordered pairs and Set Identities. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation. **Functions:** Definition, Classification of functions, Operation son functions, recursively defined functions.	8
II	**Posets, Hasse Diagram and Lattices:** Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction of lattices, Properties of lattices–Bounded, Complemented, Modular and Complete lattice. **Boolean Algebra:** Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean functions, Karnaugh maps, Logic gates.	8
III	**Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection. **Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic.	8
IV	**Algebraic Structures:** Introduction to algebraic Structures and properties. Types of algebraic structures: Semi group, Monoid, Group, Abelian group and Properties of group. Subgroup, Cyclic group, Cosets, Permutation	8

	groups, Homomorphism and Isomorphism of groups. **Rings and Fields:** Definition and elementary properties of Rings and Fields.	
V	**Natural Numbers:** Introduction, Piano's axioms, Mathematical Induction, Strong Induction and Induction with Non zero Base cases. **Recurrence Relation & Generating functions:** Introduction and properties of Generating Functions. Simple Recurrence relation with constant coefficients and Linear recurrence relation without constant coefficients. Methods of solving recurrences. **Combinatorics:** Introduction, Counting techniques and Pigeon hole principle, Polya's Counting the Orem.	8

Text Books:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill, 2006.
2. B. Kolman, R.C Bus by and S.C Ross, "Discrete Mathematics Structures", Prentice Hall, 2004.

Reference

1. Krishnamurthy, "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi.
2. Liptschutz, Seymour, "Discrete Mathematics", McGraw Hill Approach", Acme Learning, New Delhi-2011

Evaluation/Assessment Methodology

	Max. Marks :100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to identify the properties of functions and relations.
CO1: Able to understand the concepts of sets and perform operations.
CO3: Able to verify the correctness of an argument using truth tables.
CO4: Able to solve problem using counting techniques and combinatorics.
CO5: Able to analyze preposition and predicate logics.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Computer Organization & Architecture**
Course Code: MCA - 115	**Title: Computer Organization & Architecture**

Course Objectives:
CO1: Describe functional units of digital system and explain how arithmetic and logical operations a reaper formed by computers.
CO2: Describe the operations of control unit and write sequence of instructions for carrying out simple operation u sing various addressing modes.
CO3: Design various types of memory and its organization.
CO4: Describe the various modes in which IO devices communicate with CPU and memory.
CO5: List the criteria for classification of parallel computer and describe various architectural schemes.

Nature of Paper: CORE COURSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Functional units of digital system and their inter connections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. **Process or organization:** general registers organization, stack organization and addressing modes.	8
II	**Arithmetic and logic unit:** Looka head carries adders. Multiplication: Signed opera and multiplication, Booth's algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers.	8
III	**Control Unit:** Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro-operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hard wire and micro programmed control: micro-program sequencing, concept of horizontal and vertical micro programming.	8
IV	**Memory:** Basic concept and hierarchy, semi conductor RAM memories, 2D & 21/2D memory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and	8

	optical disks Virtual memory: concept implementation.	
V	**Input / Output:** Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access, I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	8

Text Books:

1. John P.Hayes, "Computer Architecture and Organization", Mc Graw Hill.
2. William Stallings, "Computer Organization and Architecture-Designing for Performance", Pearson Education.
3. M. Morris Mano, "Computer System Architecture", PHI.

Reference

1. David A. Patterson and John L. Hennessy, Computer Architecture- A Quantitative Approach", Elsevier Pub.
2. Tannen baum, "Structured Computer Organization", PHI.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: For a microprocessor system, student should be able to deal with the internal architecture of 8 bits and 16-bit microprocessor to analyze the working operation and to know the pin configuration for the respective microprocessor. A student should be good enough to deal with interrupts internally or externally.

CO2: He/she should be able to understand the basic concepts of Assembly language programming. For a particular data instruction set, student should be having a clear idea of solving machine language programs using kit. He/she shall be having an idea to tackle with counter delays and subroutines.

CO3: He/she should be able to know the concept of pipelining and parallelism in uniprocessor system for hazard detection. Understand the basic concept of Parallel computing.

CO4: A student should have a basic idea of job levels that are governed by an organization on priority basis. He/she should know the Pipeline scheduling theory.

CO5: For good networking, a student should be able to draw SIMD interconnections and FFT or a butterfly method system for collision prevention and vector dispatching. He/she should be able to make Cube Interconnection Network, Shuffle-Exchange and Omega Network.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Program: Degree **Class: MCA**	**Year: I** **Semester: I**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Computer Organization & Architecture Lab**
Course Code: MCA -117P	**Title: Computer Organization & Architecture Lab**

Course Objectives:
CO1: Design and verify combinational circuits (adder, code converter, decoder, multiplexer) using basic gates.
CO2: Design and verify various flip-flops.
CO3: Design I/O system and ALU.
CO4: Demonstrate combinational circuit using simulator.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Implementing HALF ADDER, FULL ADDER using basic logic gates	02
II	Implementing Binary-to-Gray, Gray-to-Binary code conversions.	02
III	Implementing 3–8-line DECODER. Implementing 4x1 and 8x1 MULTI PLEXERS.	02
IV	Verify the excitation tables of various FLIP-FLOPS	02
V	Design of an 8-bit Input / Output system with four 8-bit Internal Registers.	02
VI	Design of an 8-bit ARITHMETIC LOGIC UNIT.	02
VII	Design the data path of a computer from its register transfer language description.	02
VIII	Design the control unit of a computer using either hardwiring or micro programming based on its register transfer language description.	02

Reference / Text Books:

- John P. Hayes, "Computer Architecture and Organization", Mc Graw Hill.
- William Stallings, "Computer Organization and Architecture-Designing for Performance", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	10
2) Presentations/Seminar	10
3) Assignments	-
4) Research Project Report	-

Seminar On Research Project Report 5) ESE	 30
Total:	**50**
Program Learning Outcomes: CO1: Students will be able to develop flip-flops. CO2: Students will be able to solve problems based on circuit design. CO3: Students will be able to learn working of ALU. CO4: Students will be able to Implement Binary-to -Gray, Gray -to -Binary code conversions CO5: Students will be able to work with logic gates.	

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Program: Degree **Class: MCA**	**Year: I** **Semester: I**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Problem-Solving using C Lab**
Course Code: MCA -116P	**Title: Problem-Solving using C Lab**

Course Objectives:

CO1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.

CO2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements.

CO3: Students will be familiar with the concept of Arrays, Pointers, Functions, categories of function, and recursion.

CO4: Students will be able to develop a Program with Structure; learn Union and Complete String Operations.

CO5: Students will be familiar with File handling programs to perform read-write operations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a program to display “hello world” in C.	02
II	Write a program to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd.	02
III	Write a program to check whether the entered year is a leap year or not (a year is a leap if it is divisible by 4 and divisible by 100 or 400.)	02
IV	Write a program to read a string and check for palindrome without using string-related functions (a string is a palindrome if its half is mirror by itself.	02
V	Write a program to find the biggest among three numbers using a pointer.	02
VI	Create a structure named company which has a name, address, phone, and as member variables. Read the name of the company, its address, phone, and no Of Employee. Finally display these members’ values.	02
VII	The BCT class and display the details from the function.	02
VIII	Write a program to show programming examples with unions and structures.	02

Reference / Text Books:

- ❖ The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie.
- ❖ C Programming: A Modern Approach" by K. N. King.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	10
2) Presentations /Seminar	10
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	30
Total:	**50**

Program Learning Outcomes:

CO1: Students will be able to develop programs based on fundamental concepts of programming in C.

CO2: Students will be able to solve problems based on Conditional and Iterative Control Statements.

CO3: Students will be able to learn Complete Programming Concepts of Arrays, Pointers and get familiar with modular programming Concepts of C using Functions.

CO4: Students will be able to learn conceptual programming with String, Structure, and its differentiation with Union.

CO5: Students will be able to perform File handling programs with read and write concepts

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Theory of automata and formal languages**
Course Code: MCA - 121	**Title: Theory of automata and formal languages**

Course Objectives:

CO1: Define various types of automata for different classes off or mal languages and explain their working.
CO2: State and prove key properties of formal languages and automata.
CO3: Construct appropriate formal notations (such as grammars, acceptors, transducers and regular expressions) for given formal languages.
CO4: Convert among equivalent notations for formal languages.
CO5: Explain the significance of the Universal Turing machine, Church-Turing thesis and concept of Undesirability.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Basic Concepts and Automata Theory:** Introduction to Theory of Computation-Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)-Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output-Moore machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata, My hill-Nerode Theorem, Simulation of DFA and NFA.	8
II	**Regular Expressions and Languages:** Regular Expressions, Transition Graph, Kleen's Theorem, Finite Automata and Regular Expression-Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages-Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability-Decision properties, Finite Automata and Regular Languages, Regular Languages and Computers, Simulation of Transition Graph and Regular language.	8
III	**Regular and Non-Regular Grammars**: Context Free Grammar (CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG	8

	and Regular grammar into FA, Simplification of CFG, Normal Forms-Chomsky Normal Form(CNF), Greibach Normal Form (GNF), Chomsky Hierarchy, Programming problems based on the properties of CFGs.	
IV	**Push Down Automata and Properties of Context Free Languages**: Nondeterministic Push down Automata (NPDA)-Definition, Moves, A Language Accepted by NPDA, Deterministic Push down Automata (DPDA) and Deterministic Context free Languages (DCFL), Push down Automata for Context Free Languages, Context Free grammars for Pushdown Automata, Two stack Pushdown Automata, Pumping Lemma for CFL, Closure properties of CFL, Decision Problems of CFL, Programming problems based on the properties of CFLs.	8
V	**Turing Machines and Recursive Function Theory**: Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem, Post Correspondence Problem, Introduction to Recursive Function Theory.	8

Text Books:

1. J.E. Hopcraft, R. Motwani, and Ullman, "Introduction to Automata theory, Languages and Computation", Pearson Education Asia, 2nd Edition.
2. J. Martin, "Introduction to languages and the theory of computation", McGraw Hill, 3rd Edition.

Reference

1. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science Automata Languages and Computation", PHI.
2. Y.N. Singh, "Mathematical Foundation of Computer Science", New Age International.

Evaluation/Assessment Methodology

Max. Marks:100

1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand various types of automata and their working.
CO2: Understand key properties of formal languages and automata.
CO3: Able to construct automata for given formal languages.
CO4: Able to Convert among equivalent annotations for formal languages.
CO5: Understand the concept of Universal Turing machine, Church-Turing thesis and concept of Undesirability.

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Object oriented programming**
Course Code: MCA - 122	**Title: Object oriented programming**

Course Objectives:
CO1: Definition of Object-Oriented Programming techniques.
CO2: Apply Object Oriented Programming techniques using Java.
CO3: Solve the real-world problems using of Packages, Interfaces, and apply Exceptions handling and Threading concepts in Java.
CO4: Develop I/O and GUI applications in java.
CO5: Design Database applications and swing programming in Java.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Object Oriented Programming: objects, classes, Abstraction, Encapsulation, Inheritance, Polymorphism, OOP in Java, Characteristics of Java, The Java Environment, Java Source File Structure, and Compilation. Fundamental Programming Structures in Java: Defining classes in Java, constructors, methods, access specifies, tatic members, Comments, Data Types, Variables, Operators, Control Flow, Arrays.	8
II	**Inheritance, Interfaces, and Packages:** Inheritance: Super classes, sub classes, Protected members, constructors in sub classes, Object class, abstract classes and methods. Interfaces: defining an interface, implementing interface, differences between classes and interfaces and extending interfaces, Object cloning, inner classes. Packages: Defining Package, CLASS PATH Setting for Packages, Making JAR Files for Library Packages, Import and Static Import Naming Convention For Packages, Networking java. net package.	8
III	**Exception Handling, I/O**: Exceptions: exception hierarchy, throwing and catching exceptions, built-in exceptions, creating own exceptions, Stack Trace Elements. Input /Output Basics: Byte streams and Character streams, Reading and Writing, Console Reading and Writing Files.	8
IV	**Multithreading and Generic Programming:** Differences between multi-threading and multi-tasking, thread lifecycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads,	8

	thread groups. Generic Programming: Generic classes, generic methods, Bounded Types: Restrictions and Limitations.	
V	**Event Driven Programming:** Graphics programming: Frame, Components, working with 2D shapes, Using colors, fonts, and images. Basics of event handling: even thandlers, adapter classes, actions, mouse events, AWT event hierarchy. Introduction to Swing: layout management, Swing Components: Text Fields, Text Areas, Buttons, Check Boxes, Radio Buttons, Lists, choices, Scrollbars, Windows Menus and Dialog Boxes.	8

Text Books:

1. Patrick Naughton and Herbertz Schildt, "Java-2 The Complete Reference", Mc Graw Hill.
2. Ivor Horton, "Beginning Java-2", Wiley Publishing.
3. Bala guru swamy, "Programming with Java: A Primer", Tata McGraw Hill Education

Reference

1. Horetmann Cay and Cornell Gary, "Core Java Volume – I", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report	10
Seminar On Research Project Report	
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of Packages, Interfaces, abstraction, Exceptions and threading concepts in Java
CO4: Able to understand the use of I/O and GUI programming in java.
CO5: Able to develop and understand database applications and Swing programming in Java.

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA**	**Year : I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Operating system**
Course Code: MCA - 123	**Title: Operating system**

Course Objectives:
CO1: Explain main components, services, types and structure of Operating Systems.
CO2: Apply the various algorithms and techniques to handle the various concurrency control issues.
CO3: Compare and apply various CPU scheduling algorithms for process execution.
CO4: Identify occurrence of dead lock and describe ways to handle it.
CO5: Explain and apply various memory, I/O and disk management techniques.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction**: Operating System Structure-Layered structure, System Components, Operating system functions, Classification of Operating systems-Batch, Interactive, Time-sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multi process Systems, Multithreaded Systems, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.	8
II	**Concurrent Processes**: Process Concept, Principle of Concurrency, Producer / Consumer Problem, Mutual Exclusion, Critical Section Problem, Dekker's solution, Peterson's solution, Semaphores, Test and Set operation, Classical Problem in Concurrency-Dining Philosopher Problem, Sleeping Barber Problem, Inter Process Communication models and Schemes, Process generation.	8
III	**CPU Scheduling:** Scheduling Concepts, Performance Criteria, Process States, Process Transition Diagram, Schedulers, Process Control Block (PCB), Process address space, Process identification information, Threads and their management, Scheduling Algorithms, Multiprocessor Scheduling. Dead lock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from dead lock.	8
IV	**Memory Management:** Basic bare machine, Resident monitor, Multi programming with fixed partitions, Multi programming with variable partitions, Protection schemes, Paging, Segmentation, Paged segmentation, Virtual memory concepts, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference.	8
V	**I/O Management and Disk Scheduling**: I/O devices, and I/O sub systems, I/O	8

	buffering, Disk storage and disk scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.	

Text Books:

1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley Publication.
2. Sibsankar Halder and Alex A Arvind, "Operating Systems", Pearson Education

Reference

1. Harvey M Dietel, "An Introduction to Operating System", Pearson Education.
2. William Stallings, "Operating Systems: Internals and Design Principles", 6th Edition, Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe the important computer system resources and the role of operating system in their management policies and algorithms.
CO2: Understand the process management policies and scheduling of processes by CPU.
CO3: Evaluate the requirement for process synchronization and coordination handled by operating system.
CO4: Describe and analyze the memory management and its allocation policies.
CO5: Identify use and evaluate the storage management policies with respect to different storage management technologies.

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: DATA BASE MANAGEMENT SYSTEM**
Course Code: MCA- 124	**Title: DATA BASE MANAGEMENT SYSTEM**

Course Objectives:
CO1: Explain the concept of features of a database system and its application and compare various types of data models.
CO2: Describe the E-R Models and Relational Database.
CO3: Explain the concept of SQL Commands, relational algebra, tuple calculus and domain calculus.
CO4: Explain the need of normalization and normalize a given relation to the desired normal form.
CO5: Analyze the different approaches of transaction processing and concurrency control.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Overview, Database System vs File System, Data base System Concept and Architecture, Data Model Schema and Instances, Data Independence and Data base Language and Interfaces, Data Definitions Language, DML, Overall Data base Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	8
II	**Relational data Model and Language:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL	8
III	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less joined compositions, normalization using FD,	8

	MVD, and JDs, alternative approaches to data base design	
IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Dead lock Handling. Distributed Data base: Distributed Data Storage, Concurrency Control, Directory System.	8
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	8

Text Books:

1. Korth, Silbertz, Sudarshan," Database Concepts", Mc Graw Hill.
2. Date C J, "An Introduction to Database Systems", Addision Wesley.
3. Elmasri, Navathe, "Fundamentals of Database Systems", Addision Wesley.
4. O'Neil, "Databases", Elsevier Pub

Reference

1. Ramakrishnan, "Database Management Systems", McGraw Hill.
2. Leon & Leon, "Database Management Systems", Vikas Publishing House.
3. Bipin C. Desai, "An Introduction to Database Systems", Gagotia Publications.
4. Majumdar& Bhattacharya, "Database Management System", Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Describe the features of a database system and its application and compare various types of data models.
CO2: Construct an ER Model for a given problem and transform it into a relation database schema.
CO3: Formulate solution to a query problem using SQL Commands, relational algebra, tuple calculus and domain calculus.
CO4: Explain the need of normalization and normalize a given relation to the desired normal form.
CO5: Explain different approaches of transaction processing and concurrency control.

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Data structure and analysis of algorithms**
Course Code: MCA- 125	**Title: Data structure and analysis of algorithms**

Course Objectives:

CO1: Explain the concept of data structure, abstract data types, algorithms, analysis of algorithms and basic data organization schemes such as arrays and linked lists.
CO2: Describe the applications of stacks and queues and implement various operations on the musing arrays and linked lists.
CO3: Describe the properties of graphs and trees and implement various operations such as searching and traversal on them.
CO4: Compare incremental and divide-and-conquer approaches of design in gal gorithms for problems such assorting and searching.
CO5: Apply and analyze various design approaches such as Divide-and-Conquer, greedy and dynamic for problem solving.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to data structure:** Data, Entity, Information, Difference between Data and Information, Data type, Build in data type, Abstract data type, Definition of data structures, Types of Data Structures: Linear and Non-Linear Data Structure, Introduction to Algorithms: Definition of Algorithms, Difference between algorithm and programs, properties of algorithm, Algorithm Design Techniques, Performance Analysis of Algorithms, Complex it y of various code structures, Order of Growth, Asymptotic Notations. **Arrays:** Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D Array Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable.	8
II	**Stacks**: Abstract Data Type, Primitive Stack operations: Push & Pop,	8

	Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of post fix expression, Iteration and Recursion-Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue. **Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collisionre solution Techniques used in Hashing.	
III	**Sorting:** Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time: Counting Sort and Bucket Sort. **Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component.	8
IV	**Trees:** Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Complete Binary Tree, A Extended Binary Trees, Tree Traversal algorithms: In order, Preorder and Post order, Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search Tree. Threaded Binary trees, Huffman coding using Binary Tree, AVL Tree and B Tree.	8
V	Divide and Conquer with Examples Such as Merge Sort, Quick Sort, Matrix Multiplication: Strassen's Algorithm Dynamic Programming: Dijikstra Algorithm, Bell man Ford Algorithm, All-pair Shortest Path: Warshal Algorithm, Longest Common Sub-sequence Greedy Programming: Primsand Kruskal algorithm.	8

Text Books:

1. Cormen T.H., Leiserson C.E., Rivest R.L., and Stein C., "Introduction to Algorithms", PHI.
2. Horowitz Ellis, Sahni Sartaj and Rajasekharan S., "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.

Reference

1. Lipschutz, Data Structures With C-SIE-SOS, McGraw Hill.
2. Samanta D., "Classic Data Structures", 2nd Edition Prentice Hall India.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL
Course Learning Outcomes: CO1: Understand the concept of data structure and various algorithms. CO2: Able to analyze the performance of algorithms. CO3: Understand which algorithm or data structure to use in different scenarios. CO4: Use various data structures effectively in application programs. CO5: Understand various types of sorting and their algorithms

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA**	**Year: I** **Semester: II**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: OOPS USING JAVA LAB**
Course Code:MCA-126P	**Title: OOPS USING JAVA LAB**

Course Objectives:
CO1: To write GUI programs using swing in java.
CO2: To write programs implementing OOPS concepts.
CO3: To write programs based on real world problems using java collection frame work.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a program to enter a number from user and print the odd numbers between 1 to that number.	2
II	Write a Program to find perimeter of square if area is entered by user.	2
III	Write a program to handle Array index Out Of Bounds exception.	2
IV	Write a Java program to copy an array by iterating the array.	2
V	Write a program to demonstrate a divide by zero program exception.	2
VI	Write a Java program to get the character at the given index within the String.	2
VII	Write a program to find the sum of each row of a matrix.	2
VIII	Write a program to find area of rectangle using parameterized constructor.	2

Reference / Text Books:
1. Patrick Naughton and Herbertz Schildt, “Java-2 The Complete Reference”, Mc. Graw Hill.
2. Balaguruswamy, “Programming with Java: A Primer”, Tata Mc Graw Hill Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	-
5) ESE	30
Total:	**50**

Course Learning Outcomes: Student will be able to:
CO1: Write programs based on real world problems using java collection frame work...
CO2: Write GUI programs using swing in java.
CO3: Implement OOPS concepts.

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA**	**Year: I** **Semester: II**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Data Base Management System Lab**
Course Code: MCA-127P	**Title: Data Base Management System Lab**

Course Objectives:
To learn the student should be made to:
CO1: Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
CO2: Be familiarized with a query language
CO3: Have hands on experience on DDL Commands
CO4: Have a good understanding of DML Commands and DCL commands
CO5: Familiarize advanced SQL queries and exposed to different applications

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L:0
T:0
P:4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Creation of a database and writing SQL queries to retrieve information from the database.	2
II	Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.	2
III	Perform the following: a. Viewing all databases, creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting b. Records in a Table, Saving (Commit) and Undoing (roll back).	2
IV	Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, backing up / restoring a Database.	2
V	For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer Join Sub queries- With IN clause, With EXISTS clause.	2
VI	For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting	2

	from view.	
VII	Write a Pl/SQL program using FOR loop to insert ten rows into a database table.	2
VIII	Given the table EMPLOYEE (Emp No, Name, Salary, Designation, Dept ID) write a cursor to select the five highest paid employees from the table.	2

Reference / Text Books:

1. Fundamentals of Database System By Elmasari & Nava the, 7th Edition, 2018, Pearson Education.
2. Database System Concepts by Silberschatz, Korth & Sudarshan, 6th Edition, 2019, McGraw-Hill Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	30
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Design and implement a database schema for a given problem-domain

CO2: Populate and query a database

CO3: Create and maintain tables using PL/SQL.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Artificial Intelligence**
Course Code: MCA-231	**Title: Artificial Intelligence**

Course Objectives:
CO1: Define the meaning of intelligence and study various intelligent agents.
CO2 Understand, analyze and apply AI searching algorithms in different problem domains.
CO3: Study and analyze various models for knowledge representation.
CO4: Understand the basic concepts of machine learning to analyze and implement widely used learning methods and algorithms.
CO5: Understand the concept of pattern recognition and evaluate various classification and clustering techniques

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Artificial Intelligence:** Introduction to artificial intelligence, Historical development and foundation areas of artificial intelligence, Tasks and application areas of artificial intelligence. Introduction, types and structure of intelligent agents, Computer Vision, Natural language processing.	08
II	**Searching Techniques:** Introduction, Problem solving by searching, Searching for solutions, Uniformed searching techniques, Informed searching techniques, Local search algorithms, Adversarial search methods, Search techniques used in games, Alpha-Beta pruning.	08
III	**Knowledge Representation and Reasoning:** Propositional logic, Predicate logic, First order logic, Inference in first order logic, Clause form conversion, Resolution. Chaining- concept, forward chaining and backward chaining, Utility theory and Probabilistic reasoning, Hidden Markov model, Bayesian networks.	08
IV	**Machine Learning:** Introduction, types and application areas, Decision trees, Statistical learning methods, Learning with complete data - concept and Naïve Bayes models, Learning with hidden data-concept and EM algorithm, Reinforcement learning.	08
V	**Pattern Recognition:** Introduction and design principles, Statistical pattern recognition, Parameter estimation methods - Principle component analysis and Linear discrimination analysis, Classification techniques - Nearest neighbor	08

	rule and Bayes classifier, K-means clustering, Support vector machine.	

Text Book:

1. Russell S. and Norvig P., "Artificial Intelligence – A Modern Approach", Pearson Education.
2. Rich E. and Knight K., "Artificial Intelligence", McGraw Hill Publications.
3. Charnik E. and McDermott D., "Introduction to Artificial Intelligence", Pearson Education.
4. Patterson D. W., "Artificial Intelligence and Expert Systems", Prentice Hall of India Publications.

Reference Book:

1. Khemani D., "A First Course in Artificial Intelligence", McGraw Hill.
2. Winston P. H., "Artificial Intelligence", Pearson Education.
3. Thornton C. and Boulay B.," Artificial Intelligence- Strategies, Applications and Models through Search", New Age International Publishers.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Classtasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Demonstrate fundamental understanding of the history of artificial intelligence.
CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO4: Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
CO5: Demonstrate proficiency in applying scientific method to models of machine learning.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Software Engineering**
Course Code: MCA-232	**Title: Software Engineering**

Course Objectives:

CO1: Explain various software characteristics and analyze different software Development Models.
CO2: Demonstrate the contents of a SRS and apply basic software quality assurance practices to ensure that design, development meet or exceed applicable standards.
CO3: Compare and contrast various methods for software design.
CO4: Formulate testing strategy for software systems, employ techniques such as unit testing, Test driven development and functional testing.
CO5: Manage software development process independently as well as in teams and make use of various software management tools for development, maintenance and analysis.

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Similarity and Differences from Conventional Engineering Processes, Software Quality Attributes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.	08
II	**Software Requirement Specifications (SRS):** Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modelling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.	08
III	**Software Design:** Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top- Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.	08

IV	**Software Testing:** Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top Down and Bottom- Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.	08
V	**Software Maintenance and Software Project Management:** Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.	08

Text Book:

1. R S Pressman, "Software Engineering: A Practitioners Approach", McGraw Hill.
2. Pankaj Jalote, "Software Engineering", Wiley
3. Rajib Mall, "Fundamentals of Software Engineering", PHI Publication.
4. KK Aggarwal and Yogesh Singh,"Software Engineering", New Age International Publishers.

Reference Book:

1. Ghezzi, M. Jarayeri, D. Manodrioli, "Fundamentals of Software Engineering", PHI Publication.
2. I an Sommerville, "Software Engineering", Addison Wesley.
3. Kassem Saleh, "Software Engineering", Cengage Learning
4. Pfleeger, "Software Engineering", Macmillan Publication

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks / Sessional Examination	15
2. Presentations / Seminar	-
3. Assignments	-
4. Research Project Report/Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

CO2: Able to elicit, analyze and specify software requirements through a productive working relationship with various take holders of the project

CO3: Analyze and translate a specification into a design, and then realize that design practically, using an appropriate software engineering methodology.

CO4: Know how to develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice

CO5: Able to use modern engineering tools necessary for software project management, time management and software reuse.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Computer Networks**
Course Code: MCA-233	**Title: Computer Networks**

Course Objectives:

CO1: Describe communication models TCP/IP, ISO-OSI model, network topologies along with communicating devices and connecting media.
CO2: Apply knowledge of error detection, correction and learn concepts of flow control along with error control.
CO3: Classify various IP addressing techniques, sub netting along with network routing protocols and algorithms.
CO4: Understand various transport layer protocols and their design considerations along with congestion control to maintain Quality of Service.
CO5: Understand applications-layer protocols and elementary standards of cryptography and network security.

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:4
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Data Communications**: Introduction: Data communication Components and characteristics, Data representation and Dataflow. **Networks:** LAN, WAN, MAN, Topologies. **Protocols and Standards**: ISO-OSI model and TCP-IP Model. **Network Connecting Devices:** HUB, Bridge, Switch, Router and Gateways. **Transmission Media:** Guided and unguided Media **Classification and Arrangement:** Wired LANs and Wireless LANs	08
II	**Data Link Layer:** **Error Detection and Error Correction:** Types of errors, LRC, VRC, Checksum, CRC, and Hamming Code. **Flow Control and Error Control:** Stop and Wait Protocol, Sliding Window, Go-back-N-ARQ Protocol and Selective-Repeat ARQ Protocol. **Channel Allocation Protocols:** Random Access, Controlled and Channelization techniques such as ALOHA, CSMA, CSMA/CD, CDMA/CA, TDMA, FDMA, Token Passing, etc.	08
III	**Network Layer:** **Switching Techniques:** Circuit Switching, Packet Switching, and Message	08

	Switching. **Logical addressing:** IPv4 and IPv6 Address schemes, Classes and sub netting **Network Layer Protocols:** ARP, RARP, BOOTP and DHCP **Routing Techniques:** Inter domain and Intra domain routing with examples.	
IV	**Transport Layer:** **Introduction to Transport Layer**: Process-to-Process Delivery: Reliable and unreliable Connection, Port and Socket Addressing **Transport Layer Protocols with packet formats:** User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP). **Congestion Control:** Techniques for handling the Congestion Control. **Quality of Service (QoS):** Flow Characteristics and techniques to improve QoS.	08
V	**Application Layer:** **Basic Concept of Application Layer:** Domain Name System, World Wide Web, Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login. **Introduction to Cryptography:** Definition, Goal, Applications, Attacks, Encryption, decryption, public-key and private key cryptography.	08

Text Book:

1. Behrouz Forouzan, "Data Communication and Networking", Mc Graw Hill
2. Andrew Tanenbaum "Computer Networks", Prentice Hall.
3. William Stallings, "Data and Computer Communication", Pearson.

Reference Book:

1. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.
2. Peterson and Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann
3. W. A. Shay, "Understanding Communications and Networks", C engage Learning.
4. D. Comer, "Computer Networks and Internets", Pearson.
5. Behrou z Forouzan, "TCP/IP Protocol Suite", McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand Basics of Computer Networks and different Transmission Media.
CO2: Differentiate Protocols which play a major role in providing internet effectively.
CO3: Understand various protocol layers and inner operations.
CO4: Understand architectures of network protocols.
CO5: Understand security issues in network protocols.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Cryptography & Network Security**
Course Code: MCA-011	**Title: Cryptography & Network Security**

Course Objectives:

CO1: Understand various security attacks and their protection mechanism.
CO2: Apply and analyze various encryption algorithms.
CO3: Understand functions and algorithms to authenticate messages and study and apply different digital signature techniques.
CO4: Analyze different types of key distributions.
CO5: Study and appraise different IP and system security mechanism.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction to security attacks, Services and mechanism, Classical encryption techniques substitution ciphers and transposition ciphers, Cryptanalysis, Steganography, Stream and block ciphers. **Modern Block Ciphers:** Block ciphers principles, Shannon's theory of confusion and diffusion, Feistel structure, Data encryption standard (DES), Strength of DES, Idea of differential cryptanalysis, Block cipher modes of operations, Triple DES	08
II	Introduction to group, field, finite field of the form GF(p), Modular arithmetic, Prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES). Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, Security of RSA	08
III	**Message Authentication Codes:** Authentication requirements, Authentication functions, Message authentication code, Hash functions, Birthday attacks, Security of hash functions, Secure hash algorithm (SHA). **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), Proof of digital signature algorithm.	08
IV	**Key Management and distribution:** Symmetric key distribution, Diffie-Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure.	08

	Authentication Applications: Kerberos Electronic mail security: pretty good privacy (PGP), S/MIME.	
V	**IP Security:** Architecture, Authentication header, Encapsulating security payloads, Combining security associations, Key management. Introduction to Secure Socket Layer, Secure electronic transaction (SET). **System Security:** Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls.	08

Text Book:

1. Stallings W., "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. Frouzan B. A., "Cryptography and Network Security", Mc Graw Hill.

Reference Book:

1. Kahate A., "Cryptography and Network Security", Tata Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research ProjectReport	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Provide security of the data over the network.
CO2: Do research in the emerging areas of cryptography and network security.
CO3: Implement various networking protocols.
CO4: Protect any network from the threats in the world
CO5: Understand various protocols for network security to protect against the threats in the networks.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Data Warehousing & Data Mining**
Course Code: MCA-012	**Title: Data Warehousing & Data Mining**

Course Objectives:
CO1: Demonstrate knowledge of Data Warehouse and its components.
CO2: Discuss the process of Warehouse Planning and Implementation.
CO3: Discuss and implement various supervised and Non supervised learning algorithms on data.
CO4: Explain the various process of Data Mining and decide best according to type of data.
CO5: Explain process of knowledge discovery in database (KDD). Design Data Mining model.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Data Warehousing**: Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept.	08
II	**Data Warehouse Process and Technology:** Warehousing Strategy, Warehouse/management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design	08
III	**Data Mining**: Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree.	08
IV	**Classification:** Definition, Data Generalization, Analytical Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms.	08

	Clustering: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method – Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.	
V	**Data Visualization and Overall Perspective**: Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining.	08

Text Book:

1. Alex Berson, Stephen J. Smith "Data Warehousing, Data-Mining & OLAP", TMH.
2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, "Data Warehousing: Architecture and Implementation", Pearson.
3. I. Singh, "Data Mining and Warehousing", Khanna Publishing House.

Reference Book:

1. Margaret H. Dunham, S. Sridhar,"Data Mining: Introductory and Advanced Topics" Pearson Education 5. Arun K. Pujari, "Data Mining Techniques" Universities Press.
2. Pieter Adriaans, Dolf Zantinge, "Data-Mining", Pearson Education

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions.
CO2: Understand KDD process for finding interesting pattern from warehouse.
CO3: Remove redundancy and incomplete data from the dataset using data preprocessing methods.
CO4: Characterize the kinds of patterns that can be discovered by association rule mining.
CO5: Develop a data mining application for data analysis using various tools.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Software Project Management**
Course Code: MCA-013	**Title: Software Project Management**

Course Objectives:

CO1: Identify project planning objectives, along with various cost/effort estimation models.
CO2 Organize & schedule project activities to compute critical path for risk analysis
CO3: Monitor and control project activities.
CO4: Formulate testing objectives and test plan to ensure good software quality under SEI-CMM
CO5: Configure changes and manage risks using project management tools.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Project Evaluation and Project Planning:** Importance of Software Project Management–Activities–Methodologies–Categorization of Software Projects–Setting objectives–Management Principles – Management Control–Project portfolio Management–Cost-benefit evaluation technology–Risk evaluation Strategic program Management – Stepwise Project Planning.	08
II	**Project Life Cycle and Effort Estimation:** Software process and Process Models–Choice of Process models–Rapid Application development–Agile methods–Dynamic System Development Method–Extreme Programming–Managing interactive processes–Basics of Software estimation–Effort and Cost estimation techniques–COSMIC Full function points–COCOMOII–a Parametric Productivity Model.	08
III	**Activity Planning and Risk Management:** Objectives of Activity planning–Project schedules–Activities–Sequencing and scheduling–Network Planning models–Formulating Network Model–Forward Pass & Backward Pass techniques–Critical path (CRM) method–Risk identification–Assessment–Risk Planning–Risk Management–PERT technique–Monte Carlo simulation–Resource Allocation–Creation of Critical paths–Cost schedules.	08
IV	**Project Management and Control:** Framework for Management and control–Collection of data–Visualizing progress–Cost monitoring–Earned Value Analysis– Prioritizing Monitoring–Project tracking–Change control Software Configuration Management–Managing contracts–Contract Management.	08

V	**Staffing in Software Projects:** Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – DispersedandVirtualteams–Communicationsgenres–Communicationplans– Leadership.	08

Text Book:

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management" – 5th Edition, Mc Graw Hill, New Delhi, 2012.
2. Robert K. Wysocki — "Effective Software Project Management" – Wiley Publication, 2011.
3. Walker Royce: — "Software Project Management" - Addison-Wesley, 1998.
4. Gopala Swamy Ramesh, — "Managing Global Software Projects" – Mc Graw Hill Education (India), 14th Reprint 2013.

Reference Book:

1. Koontz Harold & Weihrich Heinz, "Essentials of Management", McGraw Hill 5th Edition 2008.
2. Robbins and Coulter, "Management", Prentice Hall of India, 9th edition.
3. James A. F., Stoner, "Management", Pearson Education Delhi.
4. P. D. Chaturvedi, "Business Communication", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Identify the different project contexts and suggest an appropriate management strategy.
CO2: Practice the role of professional ethics in successful software development.
CO3: Identify and describe the key phases of project management.
CO4: Determine an appropriate project management approach.
CO5: Evaluation of the business context and scope of the project.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Cloud Computing**
Course Code: MCA-014	**Title: Cloud Computing**

Course Objectives:

CO1: Understand the concepts of Cloud Computing, key technologies, strengths and limitations of cloud computing.
CO2: Develop the ability to understand and use the architecture to compute and storage cloud, service and models.
CO3: Understand the application in cloud computing.
CO4: Learn the key and enabling technologies that help in the development of cloud.
CO5: Explain the core issues of cloud computing such as resource management and security.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds–Major Players in Cloud Computing-issues in Clouds-Eucalyptus - Nimbus - Open Nebula, Cloud Sim.	08
II	**Cloud Services:** Types of Cloud services: Software as a Service- Platform as a Service–Infrastructure as a Service-Database as a Service - Monitoring as a Service–Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.	08
III	**Collaborating Using Cloud Services:** Email Communication over the Cloud-CRM Management–Project Management-Event Management - Task Management–Calendar-Schedules-Word Processing–Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.	08
IV	**Virtualization for Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, V Mware, Virtual Box, Hyper-V.	08
V	**Security, Standards and Applications:** Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open	08

	Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud. Hadoop – Map Reduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine	

Text Book:

1. David E.Y. Sarna, "Implementing and Developing Cloud Application", CRC press 2011.
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May 2011.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata Mc Graw-Hill 2010.

Reference Book:

1. Haley Beard, "Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand the fundamental principles of distributed computing.
CO2: Understand how the distributed computing environments known as Grids can be built from lower level services.
CO3: Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
CO4: Analyze the performance of Cloud Computing.
CO5: Understand the concept of Cloud Security.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Compiler Design**
Course Code: MCA-015	**Title: Compiler Design**

Course Objectives:

CO1: Acquire knowledge of different phases and passes of the compiler and also able to use the compiler tools like LEX, YACC, etc. Students will also be able to design different types of compiler tools to meet the requirements of the realistic constraints of compilers.
CO2: Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.
CO3: Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.
CO4: Acquire knowledge about run time data structure like symbol table organization and different techniques used in that
CO5: Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Compiler**: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.	08
II	**Basic Parsing Techniques:** Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.	08
III	**Syntax-directed Translation:** Syntax-directed Translation schemes, Implementation of Syntax-directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples,	08

	translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.	
IV	**Symbol Tables**: Data structure for symbols tables, representing scope information. Run-Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.	08
V	**Code Generation:** Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.	08

Text Book:

1. K. Muneeswaran, Compiler Design, First Edition, Oxford University Press.
2. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata Mc Graw-Hill, 2003.
3. Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.

Reference Book:

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education
2. V Raghvan, " Principles of Compiler Design", TMH
3. Kenneth Louden," Compiler Construction", Cengage Learning.
4. Charles Fischer and Ricard Le Blanc," Crafting a Compiler.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain the concepts and different phases of compilation with compile time error handling.
CO2: Represent language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a language.
CO3: Compare top down with bottom up parsers, and develop appropriate parser to produce parse tree representation of the input.
CO4: Generate intermediate code for statements in high level language.
CO5: Design syntax directed translation schemes for a given context free grammar. Generation and techniques used for code optimization.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Web Technology**
Course Code: MCA-021	**Title: Web Technology**

Course Objectives:

CO1: Apply the knowledge of HTML and CSS to develop web application and analyze the insights of internet programming to implement complete application over the web.
CO2: Understand, analyze and apply the role of JavaScript in the workings of the web and web applications.
CO3: Understand, analyze and build dynamic web applications using servlet and JSP.
CO4: Develop Spring-based Java applications using Java configuration, XML configuration, annotation-based configuration, beans and their scopes, and properties.
CO5: Develop web application using Spring Boot and REST Ful Web Services

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Web Page Designing:** Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, HTML-Introduction, HTML Tags, HTML-Grouping Using Div& Span, HTML-Lists, HTML-Images, HTML- Hyperlink, HTML-Table, HTML-I frame, HTML-Form, Introduction of CSS, CSS Syntax, External Style Sheet using < link >, Multiple Style Sheets, Value Lengths and Percentages, CSS-Selectors, CSS-Box Model, Floats, Clear, Introduction to Bootstrap.	08
II	**Scripting:** Introduction to JavaScript, Creating Variables in JavaScript, Creating Functions in JavaScript, UI Events, Returning Data from Functions, Working with Conditions, looping in JavaScript, Block Scope Variables, Working with Objects, Creating Object using Object Literals, Manipulating DOM Elements with JavaScript	08
III	**Web Application development using JSP & Servlets:** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session. Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries.	08

IV	**Spring:** Spring Core Basics-Spring Dependency Injection concepts, Introduction to Design patterns, Factory Design Pattern, Strategy Design pattern, Spring Inversion of Control, AOP, Bean Scopes- Singleton, Prototype, Request, Session, Application, Web Socket, Auto wiring, Annotations, Life Cycle Call backs, Bean Configuration styles	08
V	**Spring Boot:** Spring Boot-Spring Boot Configuration, Spring Boot Annotations, Spring Boot Actuator, Spring Boot Build Systems, Spring Boot Code Structure, Spring Boot Runners, Logger, BUILDING RESTFUL WEB SERVICES, Rest Controller, Request Mapping, Request Body, Path Variable, Request Parameter, GET, POST, PUT, DELETE APIs, Build Web Applications	08

Text Book:

1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley
2. Xavier, C, "Web Technology and Design" , New Age International
3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication

Reference Book:

1. Bhave, "Programming with Java", Pearson Education
2. Hans Bergsten, "Java Server Pages", SPD O'Reilly
3. Naughton, Schildt, "The Complete Reference JAVA2",TMH

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/ Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Students are able to develop a dynamic webpage by the use of java script and DHTML.
CO2: Students will be able to write a well formed / valid XML document.
CO3: Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.
CO4: Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database.
CO5: Students will be able to write a server side java application called JSP to catch form data sent from client and store it on database.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Big Data**
Course Code: MCA-022	**Title: Big Data**

Course Objectives:

CO1: Demonstrate knowledge of Big Data Analytics concepts and its applications in business.
CO2 Demonstrate functions and components of Map Reduce Framework and HDFS.
CO3: Develop queries in No SQL environment.
CO4: Explain process of developing Map Reduce based distributed processing applications.
CO5: Explain process of developing applications using HBASE, Hive, Pig etc.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	08
II	**Hadoop:** History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System. **Map-Reduce:** Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce	08
III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O: Compression, serialization, Avro and file-based data structures. Hadoop Environment:	08

	Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security in Hadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud	
IV	**Hadoop Eco System and YARN:** Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. **No SQL** Databases: Introduction to No SQL Mongo DB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections **Spark**: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN **SCALA:** Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.	08
V	**Hadoop Eco System Frameworks**: Applications on Big Data using Pig, Hive and H Base. **Pig** : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, **Hive** - Apache Hive architecture and installation, Hive shell, Hive services, Hive meta store, comparison with traditional databases, Hive QL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & sub queries. **H Base**– H base concepts, clients, example, H base vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Info sphere, Big Insights and Big Sheets, introduction to Big SQL.	08

Text Book:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
2. Big-Data Black Book, DT Editorial Services, Wiley.
3. Dirk de Roos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill.

Reference Book:

1. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers and Techniques", Prentice Hall.
2. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons.
3. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ",VPT

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Identify Big Data and its Business Implications.
CO2: List the components of Hadoop and Hadoop Eco-System
CO3: Access and Process Data on Distributed File System
CO4: Manage Job Execution in Hadoop Environment
CO5: Develop Big Data Solutions using Hadoop Eco System

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Simulation and Modelling**
Course Code: MCA-023	**Title: Simulation and Modelling**

Course Objectives:

CO1: Study the concept of system, its components and types.
CO2 Understand and analyze nature and techniques of major simulation models.
CO3: Study and simulation. Analyze the idea of continuous and discrete system.
CO4: Understand the notion of system dynamics and system dynamics diagrams.
CO5: Finding critical path computation and understanding PERT networks

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	System definition and components, stochastic activities, continuous and discrete systems, System modeling, Types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study.	08
II	System simulation, Need of simulation, Basic nature of simulation, techniques of simulation, comparison of simulation and analytical methods, types of system Simulation, real time simulation, hybrid simulation, simulation of pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag model, Cobweb model.	08
III	Simulation of continuous Systems, analog vs digital simulation, simulation of water reservoir system, simulation of a servo system, simulation of an auto-pilot. Discrete system simulation, fixed time step vs. event-to-event model, generation of random numbers, test of randomness, Monte-Carlo computation vs. stochastic simulation.	08
IV	System dynamics, exponential growth models, exponential decay models, logistic curves, system dynamics diagrams, world model.	08
V	Simulation of PERT networks, critical path computation, uncertainties in activity duration, resource allocation and consideration, Simulation languages, object oriented simulation	08

Text Book:

1. Geoffrey Gordon, “System Simulation”, PHI
2. Narsingh Deo, “System Simulation with digital computer”, PHI.

Reference Book: 1. Averill M. Law and W. David Kelton, "Simulation Modelling and Analysis", TMH.	
Evaluation/Assessment Methodology	
	Max. Marks 100
1. Class tasks/Sessional Examination 2. Presentations/Seminar 3. Assignments 4. Research Project Report Seminar On Research Project Report 5. ESE	15 - - 10 75
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Describe the role of important elements of discrete event simulation and modeling paradigm. CO2: Conceptualize real world situations related to systems development decisions, originating from source requirements and goals. CO3: Interpret the model and apply the results to resolve critical issues in a real world environment. CO4: Apply random number variates to develop simulation models. CO5: Analyze output data produced by a model and test validity of the model	

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Software Testing & Quality Assurance**
Course Code: MCA-024	**Title: Software Testing & Quality Assurance**

Course Objectives:

CO1: Test the software by applying testing techniques to deliver a product free from bugs.
CO2: Investigate the scenario and select the proper testing technique.
CO3: Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.
CO4: Understand how to detect, classify, prevent and remove defects.
CO5: Choose appropriate quality assurance models and develop quality. Ability to conduct formal inspections, record and evaluate results of inspections.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Software Testing Basics:** Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.	08
II	**Testing Techniques and Levels of Testing:** Using White Box Approach to Test design– Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing-Unit Testing, Integration Testing, Defect Bash Elimination. System Testing-Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.	08
III	**Software Test Automation And Quality Metrics:** Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality.	08

IV	**Fundamentals of Software Quality Assurance:** SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.	08
V	**Software Assurance Models:** Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P- CMM. **Software Quality Assurance Trends:** Software Process- PSP and TSP, OO Methodology, Clean room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their effect on Software Quality.	08

Text Book:

1. Aditya P. Mathur, "Foundations of Software Testing", Pearson.
2. Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press.
3. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Auerbach Publications.
4. William Perry, "Effective Methods of Software Testing", Wiley Publishing, Third Edition.

Reference Book:

1. Renu Rajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata Mc Graw Hill.
2. Stephen Kan, "Metrics and Models in Software Quality", Addison – Wesley, 2nd Edition.
3. S. A. Kelkar, "Software quality and Testing", PHI Learning Pvt, Ltd.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Students learn to apply software testing knowledge and engineering methods

CO2: Students understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods

CO3: Students analyze and understand the use of software testing methods and modern software testing tools for their testing projects

CO4: Students identify defects and manage those defects for improvement in quality for given Software.

CO5: Choose appropriate quality assurance models and develop quality. Ability to conduct formal inspections, record and evaluate results of inspections.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Digital Image Processing**
Course Code: MCA-025	**Title: Digital Image Processing**

Course Objectives:
CO1: Explain the basic concepts of two-dimensional signal acquisition, sampling, quantization and color model.
CO2 Apply image processing techniques for image enhancement in both the spatial and frequency domains.
CO3: Apply and compare image restoration techniques in both spatial and frequency domain.
CO4: Compare edge based and region based segmentation algorithms for ROI extraction.
CO5: Explain compression techniques and descriptors for image processing.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Digital Image Fundamentals:** Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition– Image Sampling and Quantization – Relationships between pixels – Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.	08
II	**Image Enhancement:** Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	08
III	**Image Restoration:** Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics –Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	08
IV	**Image Segmentation:** Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	08

V	**Image Compression and Recognition:** Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes –Recognition based on matching.	08

Text Book:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 3rd Edition, 2010.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.
3. Kenneth R. Castleman, "Digital Image Processing" Pearson, 2006.

Reference Book:

1. D, E. Dudgeon and R M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
2. William K. Pratt, "Digital Image Processing" John Wiley, New York, 2002.
3. Milan Sonka et al, "Image processing, analysis and machine vision Brookes/Cole", Vikas Publishing House, 2nd edition, 1999.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Review the fundamental concepts of a digital image processing system.
CO2: Analyze images in the frequency domain using various transforms.
CO3: Evaluate the techniques for image enhancement and image restoration.
CO4: Categorize various compression techniques.
CO5: Interpret Image compression standards.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Artificial Intelligence Lab**
Course Code: MCA-231P	**Title: Artificial Intelligence Lab**

Course Objectives:

CO1: Study and understand AI tools such as Python / MATLAB.
CO2 Apply AI tools to analyze and solve common AI problems.
CO3: Implement and compare various AI searching algorithms.
CO4: Implement various machine learning algorithms.
CO5: Implement various classification and clustering techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (ISE+ESE)

L:0
T:0
P:4(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
	1. Installation and working on various AI tools such as Python /MATLAB.	02
	2. Programs to solve basic AI problems.	02
	3. Implementation of different AI searching techniques.	02
	4. Implementation of different game playing techniques.	02
	5. Implementation of various knowledge representation techniques.	02
	6. Program to demonstrate the working of Bayesian network.	02
	7. Implementation of pattern recognition problems such as handwritten character/ digit recognition, speech recognition, etc.	02
	8. Implementation of different classification techniques.	02
	9. Implementation of various clustering techniques.	02
	10. Natural language processing tool development	02

Text Book:

1. Russell S. and Norvig P., "Artificial Intelligence – A Modern Approach", Pearson Education.
2. Rich E. and Knight K., "Artificial Intelligence", Mc Graw Hill Publications.

Reference Book:

Book:

1. Khemani D., "A First Course in Artificial Intelligence", Mc Graw Hill.

Evaluation/Assessment Methodology	
	Max. Marks 50
1. Class tasks/Sessional Examination	25
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	-
5. ESE	25
Total:	**50**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Demonstrate understand AI tools such as Python / MATLAB. CO2: Apply various pre-processing techniques on different datasets. CO3: Construct Machine learning programs for Supervised, Unsupervised and Semi supervised learning models. CO4: Develop Deep learning programs for Supervised & Unsupervised learning models. CO5: Implement various classification and clustering techniques.	

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA**	**Year: II** **Semester: III**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Software Engineering Lab**
Course Code: MCA-232P	**Title: Software Engineering Lab**

Course Objectives:

CO1: Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement.
CO2: Identify different actors and use cases from a given problem statement and draw use case diagram to associate use cases with different types of relationship.
CO3: Draw a class diagram after identifying classes and association among them.
CO4: Graphically represent various UML diagrams and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially.
CO5: Able to use modern engineering tools for specification, design, implementation and testing.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits (ISE+ESE)

L:0
T:0
P:4(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
	1. Prepare a SRS document in line with the IEEE recommended standards.	02
	2. Draw the use case diagram and specify the role of each of the actors.	02
	3. Prepare state the precondition, post condition and function of each use case.	02
	4. Draw the activity diagram.	02
	5. Identify the classes. Classify them as weak and strong classes and draw the class diagram.	02
	6. Draw the sequence diagram for any two scenarios.	02
	7. Draw the collaboration diagram.	02
	8. Draw the state chart diagram.	02
	9. Draw the component diagram.	02
	10. Draw the deployment diagram.	02

Text Book:

1. R S Pressman, “Software Engineering: A Practitioners Approach”, McGraw Hill.
2. Pankaj Jalote, “Software Engineering”, Wiley

Reference Book:

Book:

1. Ghezzi, M. Jarayeri, D. Manodrioli, “Fundamentals of Software Engineering”, PHI Publication.
2. Ian Sommerville, “Software Engineering”, Addison Wesley.

Evaluation/Assessment Methodology	
	Max. Marks 50
1. Class tasks/Sessional Examination	25
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	-
5. ESE	25
Total:	**50**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Able to prepare SRS document, design document, test cases and software configuration management and risk management related document. CO2: Develop function oriented and object oriented software design using tools like rational rose. CO3: Able to perform unit testing and integration testing. CO4: Apply various white box and black box testing techniques CO5: Able to track the progress of a project using Open projtool.	

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Privacy and Security in Online Social Media**
Course Code: MCA-031	**Title: Privacy and Security in Online Social Media**

Course Objectives:

CO1: Understand working of online social networks
CO2 Describe privacy policies of online social media
CO3: Analyse countermeasures to control information sharing in Online social networks.
CO4: Apply knowledge of identity management in Online social networks
CO5: Compare various privacy issues associated with popular social media.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Online Social Networks:** Introduction to Social Networks, From offline to Online Communities, Online Social Networks, Evolution of Online Social Networks, Analysis and Properties, Security Issues in Online Social Networks, Trust Management in Online Social Networks, Controlled Information Sharing in Online Social Networks, Identity Management in Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs; Collecting data from Online Social Media.	08
II	**Trust Management in Online Social Networks:** Trust and Policies, Trust and Reputation Systems, Trust in Online Social, Trust Properties, Trust Components, Social Trust and Social Capital, Trust Evaluation Models, Trust, credibility, and reputations in social systems; Online social media and Policing, Information privacy disclosure, revelation, and its effects in OSM and online social networks; Phishing in OSM & Identifying fraudulent entities in online social networks	08
III	**Controlled Information Sharing in Online Social Networks:** Access Control Models, Access Control in Online Social Networks, Relationship-Based Access Control, Privacy Settings in Commercial Online Social Networks, Existing Access Control Approaches	08
IV	**Identity Management in Online Social Networks:** Identity Management,	08

	Digital Identity, Identity Management Models: From Identity 1.0 to Identity 2.0, Identity Management in Online Social Networks, Identity as Self-Presentation, Identity thefts, Open Security Issues in Online Social Networks	
V	**Case Study:** Privacy and security issues associated with various social media such as Facebook, Instagram, Twitter, LinkedIn etc.	08

Text Book:

1. Security and Privacy-Preserving in Social Networks, Editors: Chbeir, Richard, Al Bouna, Bechara (Eds.), Spinger, 2013.
2. Security and Trust in Online Social Networks, Barbara Carminati, Elena Ferrari, Marco Viviani, Morgan & Clay pool publications.
3. Security and Privacy in Social Networks, Editors: Altshuler, Y., Elovici, Y., Cremers, A.B., Aharony, N., Pentland, A. (Eds.), Springer, 2013

Reference Book:

1. Security and privacy preserving in social networks, Elie Raad & Richard Chbeir, Richard Chbeir & Bechara Al Bouna,2013
2. Social Media Security: Leveraging Social Networking While Mitigating Risk, Michael Cross, 2013.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand working of online social networks
CO2: Describe privacy policies of online social media
CO3: Analyse countermeasures to control information sharing in Online social networks.
CO4: Apply knowledge of identity management in Online social networks
CO5: Compare various privacy and security issues associated with popular social media.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Soft Computing**
Course Code: MCA-032	**Title: Soft Computing**

Course Objectives:

CO1: Recognize the need of soft computing and study basic concepts and techniques of soft computing.
CO2: Understand the basic concepts of artificial neural network to analyze widely used neural networks.
CO3: Apply fuzzy logic to handle uncertainty in various real-world problems.
CO4: Study various paradigms of evolutionary computing and evaluate genetic algorithm in solving optimization problems.
CO5: Apply hybrid techniques in applications of soft computing.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Soft Computing:** Introduction, Comparison with hard computing, Concept of learning and adaptation, Constituents of soft computing, Applications of soft computing. **Artificial Neural Networks:** Basic concepts of neural networks, Human brain, Biological neural network, History of artificial neural networks, Basic building blocks of an artificial neuron, Neural network architectures, Activation functions, Characteristics and limitation of neural networks.	08
II	**Artificial Neural Networks:** Learning methods - Supervised, Unsupervised, Reinforcement, Hebbian, Gradient descent, Competitive, Stochastic. **Major classes of neural networks:** Perceptron networks, Multilayer perceptron model, Back-propagation network, Radial basis function network, Recurrent neural network, Hopfield networks, Kohonen self-organizing feature maps.	08
III	**Fuzzy Logic:** Introduction to Fuzzy Logic, Comparison with crisp logic, Properties of classical sets, Operations on classical sets, Properties of fuzzy sets, Operations on fuzzy sets, Classical relations, Fuzzy relations, Features and types of fuzzy membership functions, Fuzzy arithmetic, Fuzzy measures. **Fuzzy Systems:** Crisp logic, Predicate logic, Fuzzy logic, Fuzzy propositions, Inference rules, Fuzzy inference systems-Fuzzification, Inference,	08

	Defuzzification, Types of inference engines.	
IV	**Evolutionary Computing:** Introduction, Evolutionary algorithm, Biological evolutionary process, Paradigms of evolutionary computing – Genetic algorithm and Genetic programming, Evolutionary strategies, Evolutionary programming. **Genetic Algorithm:** Introduction, Traditional optimization and search techniques, Comparison with traditional algorithms, Operations- Encoding, Selection, Crossover and Mutation, Classification of Genetic algorithm.	08
V	**Hybrid Soft Computing Techniques:** Introduction, Classification of hybrid systems, Neuro-fuzzy hybrid systems, Neuro-genetic hybrid systems, Fuzzy-genetic hybrid systems. **Other Soft Computing Techniques:** Tabu Search, Ant colony based optimization, Swarm Intelligence.	08

Text Book:

1. Sivanandam S.N. and Deepa S.N., "Principles of Soft Computing", Wiley-India.
2. Rajasekaran S. and Vijayalakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications", PHI Learning.
3. Chakraverty S., Sahoo D.M. and Mahato N. R., "Concepts of Soft Computing- Fuzzy and ANN with Programming", Springer.

Reference Book:

1. Kaushik S. and Tiwari S., "Soft Computing – Fundamentals, Techniques and Applications', Mc Graw Hill Education.
2. Jang J.-S.R., Sun C.-T. and Mizutani E., "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations/Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Recognize the need of soft computing and study basic concepts and techniques of soft computing.
CO2: Apply neural networks, bidirectional associative memories and adaptive resonance theory for solving different engineering problems
CO3: Identify and describe soft computing techniques and build supervised learning and unsupervised learning networks.
CO4: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
CO5: Evaluate and compare solutions by various soft computing approaches for a given problem.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Pattern Recognition**
Course Code: MCA-033	**Title: Pattern Recognition**

Course Objectives:

CO1: Study of basics of Pattern recognition. Understand the designing principles and Mathematical foundation used in pattern recognition.
CO2 Analysis the Statistical Patten Recognition.
CO3: Understanding the different Parameter estimation methods.
CO4: Understanding the different Nonparametric Techniques.
CO5: Understand and Make use of unsupervised learning and Clustering in Pattern recognition.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4 Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.	08
II	**Statistical Patten Recognition:** Bayesian Decision Theory, Classifiers, Normal density and discriminant functions	08
III	**Parameter estimation methods:** Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.	08
IV	**Nonparametric Techniques:** Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification.	08
V	**Unsupervised Learning & Clustering:** Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.	08

Text Book:

1. Duda R. O., Hart P. E. and Stork D. G., "Pattern Classification", John Wiley.
2. Bishop C. M., "Neural Network for Pattern Recognition", Oxford University Press.

Reference Book:

1. Singhal R., "Pattern Recognition: Technologies & Applications", Oxford University Press. 2. Theodoridis S. and Koutroumbas K., "Pattern Recognition", Academic Press.	
Evaluation/Assessment Methodology	
	Max. Marks 100
1. Class tasks/Sessional Examination 2. Presentations /Seminar 3. Assignments 4. Research Project Report Seminar On Research Project Report 5. ESE	20 - - 10 70
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Study of basics of Pattern recognition. Understand the designing principles and Mathematical foundation used in pattern recognition. CO2: Outline basic concepts of pattern recognition. CO3: Classify decision-making algorithms in pattern recognition. CO4: Apply Hierarchical and Partition clustering techniques in pattern recognition applications. CO5: Analyze feature selection algorithms in pattern recognition.	

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Data Analytics**
Course Code: MCA-034	**Title: Data Analytics**

Course Objectives:

CO1: Describe the life cycle phases of Data Analytics through discovery, planning and building.
CO2 Understand and apply Data Analysis Techniques.
CO3: Implement various Data streams.
CO4: Understand item sets, Clustering, frame works & Visualizations.
CO5: Apply R tool for developing and evaluating real time applications.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Data Analytics**: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. **Data Analytics Lifecycle**: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization	08
II	**Data Analysis:** Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, Neural Networks: Learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	08
III	**Mining Data Streams:** Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – Real time sentiment analysis, stock market predictions.	08
IV	**Frequent Item sets and Clustering:** Mining frequent item sets, market based	08

	modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent item sets in a stream, Clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in non-euclidean space, clustering for streams and parallelism.	
V	**Frame Works and Visualization**: Map Reduce, Hadoop, Pig, Hive, H Base, Map R, Sharding, No SQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications. **Introduction to R**-R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.	08

Text Book:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer.
2. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press.

Reference Book:

1. Bill Franks, "Taming the Big Data Tidalwave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & Sons.
2. John Garrett, "Data Analytics for IT Networks: Developing Innovative Use Cases", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand the concepts of visualization.
CO2: Explain and Analyse the Big Data using Map-reduce programming in Both Hadoop and Spark frame work.
CO3: Demonstrate spark programming and graph algorithms using programming languages.
CO4: Analyse and implement different frame work tools by taking sample data sets.
CO5: Ilustrate and implement the concepts by taking an application problem

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Software Quality Engineering**
Course Code: MCA-035	**Title: Software Quality Engineering**

Course Objectives:

CO1: Understand basic concepts of Software Quality along with its documents and process
CO2 Apply knowledge of Software Quality in various types of software
CO3: Compare the various reliability models for different scenarios
CO4: Illustrate the software Quality Planning and Assurance
CO5: Make use of various testing techniques in software implementation

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Software Quality**: Definition, Software Quality Attributes and Specification, Cost of Quality, Defects, Faults, Failures, Defect Rate and Reliability, Defect Prevention, Reduction, and Containment, Overview of Different Types of Software Review, Introduction to Measurement and Inspection Process, Documents and Metrics.	08
II	**Software Quality Metrics Product Quality Metrics**: Defect Density, Customer Problems Metric, Customer Satisfaction Metrics, Function Points, In-Process Quality Metrics: Defect Arrival Pattern, Phase-Based Defect Removal Pattern, Defect Removal Effectiveness, Metrics for Software Maintenance: Backlog Management Index, Fix Response Time, Fix Quality, Software Quality Indicators.	08
III	**Software Quality Management and Models**: Modeling Process, Software **Reliability Models**: The Rayleigh Model, Exponential Distribution and Software Reliability Growth Models, Software Reliability Allocation Models, Criteria for Model Evaluation, Software Quality Assessment Models: Hierarchical Model of Software Quality Assessment.	08
IV	**Software Quality Assurance**: Quality Planning and Control, Quality Improvement Process, Evolution of Software Quality Assurance (SQA), Major SQA Activities, Major SQA Issues, Zero Defect Software, SQA Techniques, Statistical Quality Assurance, Total Quality Management, Quality Standards and Processes.	08
V	**Software Verification, Validation & Testing:** Verification and Validation,	08

	Evolutionary Nature of Verification and Validation, Impracticality of Testing all Data and Paths, Proof of Correctness, Software Testing, Functional, Structural and Error-Oriented Analysis & Testing, Static and Dynamic Testing Tools, Characteristics of Modern Testing Tools.	

Text Book:

1. Jeff Tian, Software Quality Engineering (SQE), Wiley-Inter science, 2005; ISBN0-47-71345-7.
2. Metrics and Models in Software Quality Engineering, Stephen H. Kan, Addison Wesley (2002), ISBN:0201729156

Reference Book:

1. Norman E. Fenton and Shari Lawrence P fleeger, "Software Metrics" Thomson, 2003.
2. Mordechai Ben – Menachem and Garry S. Marliss, "Software Quality", Thomson Asia Pte Ltd, 2003.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations/Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Outline software testing and software quality assurance principles.
CO2: Prepare test case and test suites for completely testing all aspects of a system under test.
CO3: Compile findings of a quality assurance cycle.
CO4: Illustrate the software Quality Planning and Assurance
CO5: Make use of various testing techniques in software implementation

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Block chain Architecture**
Course Code: MCA-041	**Title: Block chain Architecture**

Course Objectives:

CO1: Study and understand basic concepts of block chain architecture.
CO2 Analyze various requirements for consensus protocols.
CO3: Apply and evaluate the consensus process.
CO4: Understand the concepts of Hyper ledger fabric.
CO5: Analyze and evaluate various use cases in financial software and supply chain.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Block chain:** Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. **Block chain Architecture and Design:** Basic crypto primitives: Hash, Signature, Hash chain to Block chain, Bit coin Basic, Basic consensus mechanisms.	08
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Block chain consensus protocols, distributed consensus, consensus in Bit coin. **Permissioned Block chains:** Design goals, Consensus protocols for Permissioned Block chains	08
III	**Hyper ledger Fabric:** Decomposing the consensus process, Hyper ledger fabric components. **Chain code Design and Implementation Hyper ledger Fabric:** Beyond Chain code: fabric SDK and Front End, Hyper ledger composer tool.	08
IV	**Use case 1:** Block chain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance. **Use case 2:** Block chain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.	08
V	**Use case 3:** Block chain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems, Block chain Cryptography, Privacy and Security on Block chain	08

Text Book: 1. Andreas Antonopoulos, "Mastering Bit coin: Unlocking Digital Crypto currencies", O' Reilly 2. Melanie Swa, "Block chain", O' Reilly	
Reference Book: 1. "Hyper ledger Fabric", https://www.hyperledger.org/projects/fabric 2. Bob Dill, David Smits, "Zero to Block chain - An IBM Redbooks course", https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html	
Evaluation/Assessment Methodology	
	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Describe the basic concepts and technology used for block chain. CO2: Describe the primitives of the distributed computing and cryptography related to block chain. CO3: Illustrate the concepts of Bitcoin and their usage. CO4: Implement Ethereum block chain contract. CO5: Apply security features in block chain technologies.	

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Internet of Things**
Course Code: MCA-043	**Title: Internet of Things**

Course Objectives:

CO1: Demonstrate basic concepts, principles and challenges in IoT.
CO2 Illustrate functioning of hardware devices and sensors used for IoT.
CO3: Analyze network communication aspects and protocols used in IoT.
CO4: Apply IoT for developing real life applications using Ardunio programming.
CO5: To develop IoT infrastructure for popular applications

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	08
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Net Arduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	08
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	08
IV	**Programming the Ardunio:** Ardunio Platform Boards Anatomy, Ardunio IDE, coding, using emulator, using libraries, additions in ardunio, programming the ardunio for IoT.	08
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	08

Text Book: 1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", willey 2. Jeeva Jose, Internet of Things, Khanna Publishing House 3. Michael Miller "The Internet of Things" byPearson
Reference Book: 1. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016 2. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014 3. Adrian Mc Ewen, Hakin Cassimally "Designing the Internet of Things" Wiley India

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand the application areas of IOT
CO2: Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO3: Able to understand building blocks of Internet of Things and characteristics.
CO4: Apply IoT for developing real life applications using Ardunio programming.
CO5: To develop IoT infrastructure for popular applications

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Modern Application Development**
Course Code: MCA-044	**Title: Modern Application Development**

Course Objectives:

CO1: Understand the fundamental of Kotlin Programing for Android Application Development.
CO2 Describe the UI Layout and architecture of Android Operating System.
CO3: Designing android application using Jetpack Library based on MVVM Architecture.
CO4: Developing android application based on REST API using Volley and Retrofit Library.
CO5: Ability to debug the Performance and Security of Android Applications.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Kotlin Fundamental:** Introduction to Kotlin, Basic Syntax, Idioms, Coding Conventions, Basics, Basic Types, Packages, Control Flow, Returns and Jumps, Classes and Objects, Classes and Inheritance, Properties and Fields, Interfaces, Visibility Modifiers, Extensions, Data Classes, Generics, Nested Classes, Enum Classes, Objects, Delegation, Delegated Properties, Functions and Lambdas, Functions, Lambdas, Inline Functions, Higher-Order Functions, Scope Functions, Collections, Ranges, Type Checks and Casts, This expressions, Equality, Operator overloading, Null Safety, Exceptions, Annotations, Reflection.	08
II	**Android Fundamental: Android Architecture**: Introduction to Android, Layouts, Views and Resources, Activities and Intents, Activity Lifecycle and Saving State, Implicit or Explicit Intents. **User Interaction and Intuitive Navigation:** Material Design, Theme, Style and Attributes, Input Controls, Menus, Widgets, Screen Navigation, Recycler View, List View, Adapters, Draw able, Notifications.	08
III	**Storing, Sharing and Retrieving Data in Android Applications:** Overview to storing data, shared preferences, App settings, Store and query data in Android's SQ Lite database, Content Providers, Content Resolver, Loading data using loaders. **Jetpack Components:** Fragments, Jetpack Navigation, Lifecycle, Lifecycle Observer, Lifecycle Owner, View Model, View Model Factory, View Model Provider, Live Data, Room API, Data Binding, View Binding, MVVM	08

	Architecture Basics	
IV	**Asynchronous Data Handling, Networking and Files:** Asynchronous Task, Coroutines, API Handling, JSON Parsing, Volley Library, Retrofit Library, File Handling, HTML and XML Parsing, Broadcast receivers, Services	08
V	**Permissions, Performance and Security:** Firebase, Ad Mob, APK Singing, Publish App, Packaging and deployment, Google Maps, GPS and Wi-Fi, Download Manager, Work Manager, Alarms, Location, Map and Sensors, APK Singing, Publish App	08

Text Book:

1. Meier R.,"Professionai Android 2 Application Development", Wiley.
2. Hashimi S., Komatineni S. And Mac Lean D., "Pro Android 2", Apress.
3. Murphy M., "Beginning Android 2", A press.

Reference Book:

1. Delessio C. and Darcey L., "Android Application Development", Pearson Education.
2. DiMarzio J.F., "Android a Programming Guide", Tata Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe principles, techniques and usage of modern software development process.
CO2: Solve problems related to real world application development.
CO3: Use standard practices to develop modern application.
CO4: Implement recent devices to develop application.
CO5: Evaluate modern trends of software development

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Distributed Database Systems**
Course Code: MCA-045	**Title: Distributed Database Systems**

Course Objectives:

CO1: Understand theoretical and practical aspects of distributed database systems.
CO2 Study and identify various issues related to the development of distributed database system
CO3: Understand the design aspects of object-oriented database system and related development
CO4: Equip students with principles and knowledge of distributed reliability.
CO5: Equip students with principles and knowledge of parallel and object-oriented databases.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas. Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture. Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.	08
II	**Query processing and decomposition:** Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data. Distributed query Optimization: Query optimization, centralized query optimization, distributed query optimization algorithms.	08
III	Transaction Management: Definition, properties of transaction, types of transactions, distributed concurrency control: Serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.	08
IV	**Distributed DBMS Reliability:** Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning. Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.	08
V	**Distributed object Database Management Systems:** Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.	08

	Object Oriented Data Model: Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS	

Text Book:

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, Mc Graw Hill.

Reference Book:

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe distributed database concept and architecture.
CO2: Compare the type of distributed database systems.
CO3: Display knowledge of the fragmentation in distributed database systems.
CO4: Understand of query processing, data and access control of distributed database systems.
CO5: Describe transaction management in distributed database systems

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Mobile Computing**
Course Code: MCA-051	**Title: Mobile Computing**

Course Objectives:

CO1: Study and aware fundamentals of mobile computing.
CO2 Study and analyze wireless networking protocols, applications and environment.
CO3: Understand various data management issues in mobile computing.
CO4: Analyze different environment type of security issues in mobile computing
CO5: Study, analyze, and evaluate various routing protocols used in mobile computing.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction, Issues in mobile computing, Overview of wireless telephony, Cellular concept, GSM-air interface, channel structure; Location management-HLR-VLR, hierarchical, handoffs; Channel allocation in cellular systems, CDMA, GPRS, MAC for cellular system.	08
II	Wireless Networking, Wireless LAN Overview- MAC issues, IEEE 802.11, Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, Data broadcasting, Mobile IP, WAP- architecture, protocol stack, application environment, applications.	08
III	Data management issues in mobile computing, data replication for mobile computers, adaptive clustering for mobile wireless networks, File system, Disconnected operations.	08
IV	Mobile Agents computing, Security and fault tolerance, Transaction processing in mobile computing environment.	08
V	Adhoc networks, Localization, MAC issues, Routing protocols, Global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Adhoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Adhoc Networks, applications	08

Text Book:

1. Schiller J., "Mobile Communications", Pearson
2. Upadhyaya S. and Chaudhury A., "Mobile Computing", Springer
3. Kamal R., "Mobile Computing", Oxford University Press.

Reference Book:

1. Talukder A. K. and Ahmed H., "Mobile Computing Technology, Applications and Service Creation", McGraw Hill Education
2. Garg K., "Mobile Computing Theory and Practice", Pearson.
3. Kumar S., "Wireless and Mobile Communication", New Age International Publishers

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain the basics of mobile Computing
CO2: Describe the functionality of Mobile IP and Transport Layer
CO3: Classify different types of mobile telecommunication systems
CO4: Demonstrate the Adhoc networks concepts and its routing protocols
CO5: Make use of mobile operating systems in developing mobile applications

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Computer Graphics and Animation**
Course Code: MCA-052	**Title: Computer Graphics and Animation**

Course Objectives:

CO1: Understand the graphics hardware used in field of computer graphics.
CO2 Understand the concept of graphics primitives such as lines and circle based on different algorithms.
CO3: Apply the 2D graphics transformations, composite transformation and Clipping concepts.
CO4: Apply the concepts and techniques used in 3D computer graphics, including viewing transformations, projections, curve and hidden surfaces.
CO5: Perform the concept of multimedia and animation in real life.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction and Line Generation:** Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.	08
II	**Transformations:** Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. **Windowing and Clipping:** Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against nonrectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.	08
III	**Three Dimensional:** 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping. **Curves and Surfaces:** Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.	08
IV	**Hidden Lines and Surfaces:** Back Face Detection algorithm, Depth buffer method, A- buffer method, Scan line method, basic illumination models–	08

	Ambient light, Diffuse reflection, Specular reflection and Phongmodel, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.	
V	**Multimedia Systems:** Design Fundamentals, Back ground of Art, Color theory overview, Sketching & illustration, Storyboarding, different tools for animation. **Animation:** Principles of Animations, Elements of animation and their use, Power of Motion, Animation Techniques, Animation File Format, Making animation for Rolling Ball, making animation for a Bouncing Ball, Animation for the web, GIF, Plugins and Players, Animation tools for World Wide Web.	08

Text Book:

1. Hearn D. and Baker M. P., "Computer Graphics C Version", Pearson Education
2. Foley, Vandam, Feiner, Hughes, "Computer Graphics principle", Pearson Education.
3. Rogers, " Procedural Elements of Computer Graphics", McGraw Hill

Reference Book:

1. Newman W. M., Sproull R. F., "Principles of Interactive computer Graphics", McGraw Hill.
2. Sinha A. N. and Udai A. D.," Computer Graphics", McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand how to generate line, circle and ellipse also how to create 2D object and various transformation techniques.
CO2: Understand various 3D Transformation techniques using Open GL.
CO3: Understand multimedia compression techniques and applications. Apply the concepts and
CO4: techniques used in 3D computer graphics, including viewing transformations, projections, curve and hidden surfaces.
CO5: Perform the concept of multimedia and animation in real life.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Natural Language Processing**
Course Code: MCA-053	**Title: Natural Language Processing**

Course Objectives:

CO1:	Study and understand basic concepts, background and representations of natural language.
CO2	Analyze various real-world applications of NLP.
CO3:	Apply different parsing techniques in NLP.
CO4:	Understand grammatical concepts and apply them in NLP.
CO5:	Apply various statistical and probabilistic grammar methods to handle and evaluate ambiguity.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Natural Language Understanding:** The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.	08
II	Introduction to semantics and knowledge representation, some applications like machine translation, database interface.	08
III	Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.	08
IV	**Grammars for Natural Language:** Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.	08
V	**Ambiguity Resolution:** Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.	08

Text Book:

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, "NLP: A Paninian Perspective", Prentice Hall, New Delhi.
2. James Allen, "Natural Language Understanding", Pearson Education.
3. D. Jurafsky, J. H. Martin, "Speech and Language Processing", Pearson Education.

Reference Book:

1. L. M. Ivansca, S. C. Shapiro, "Natural Language Processing and Language Representation", AAAI Press, 2000.
2. T. Winograd, Language as a Cognitive Process, Addison-Wesley.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.
CO2: Realize semantics and pragmatics of English language for text processing
CO3: Create CORPUS linguistics based on digestive approach (Text Corpus method)
CO4: Check a current method for statistical approaches to machine translation.
CO5: Perform POS tagging for a given natural language and Select a suitable language modeling technique based on the structure of the language.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Machine Learning Techniques**
Course Code: MCA-054	**Title: Machine Learning Techniques**

Course Objectives:

CO1: To understand the need for machine learning for various problem solving
CO2 To understand a wide variety of learning algorithms and how to evaluate models generated from data
CO3: To understand the latest trends in machine learning
CO4: To design appropriate machine learning algorithms and apply the algorithms to a real-world problems
CO5: To optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**INTRODUCTION** – Learning, Types of Learning, Well defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning, Decision Tree Learning, Bayesian networks, Support Vector Machine, Genetic Algorithm), Issues in Machine Learning and Data Science Vs Machine Learning;	08
II	**REGRESSION:** Linear Regression and Logistic Regression **BAYESIAN LEARNING -** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. **SUPPORT VECTOR MACHINE:** Introduction, Types of support vector kernel– (Linear kernel, polynomial kernel, and Gaussian kernel), Hyper plane – (Decision surface), Properties of SVM, and Issues in SVM.	08
III	**DECISION TREE LEARNING** - Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. **INSTANCE-BASED LEARNING** – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.	08
IV	**ARTIFICIAL NEURAL NETWORKS** – Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks,	08

	Derivation of Back propagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; **DEEP LEARNING** - Introduction, concept of convolutional neural network , Types of layers – (Convolutional Layers , Activation function , pooling , fully connected) , Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for eg on Diabetic Retinopathy, Building a smart speaker, Self-deriving car etc.	
V	**REINFORCEMENT LEARNING**–Introduction to Reinforcement Learning , Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process, Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Q Learning. **GENETIC ALGORITHMS:** Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications	08

Text Book:

1. Tom M. Mitchell,—Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin,—Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press 2004.
3. Stephen Marsland,—Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

Reference Book:

1. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
2. M. Gopal, "Applied Machine Learning", Mc Graw Hill Education

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Learn the basics of learning problems with hypothesis and version spaces
CO2: Understand the features of machine learning to apply on real world problems
CO3: Characterize the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning
CO4: Analyze the concept of neural networks for learning linear and non-linear activation functions
CO5: Learn the concepts in Bayesian analysis from probability models and method.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Quantum Computing**
Course Code: MCA-055	**Title: Quantum Computing**

Course Objectives:

CO1: Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.

CO2 Demonstrate an understanding of a quantum computing algorithm by simulating it on a classical computer, and state some of the practical challenges in building a quantum computer.

CO3: Contribute to a medium-scale application program as part of a co-operative team, making use of appropriate collaborative development tools (such as version control systems).

CO4: Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.

CO5: Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Fundamental Concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	08
II	**Quantum Computation**: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	08
III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	08
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations,	08

	Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	
V	**Quantum Error Correction:** Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource .	08

Text Book:

1. Micheal A. Nielsen. & Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
2. Eleanor G. Rieffel, Wolfgang H. Polak, "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback –Import, 3 Oct 2014
3. Computing since Democritus by Scott Aaronson

Reference Book:

1. Computer Science: An Introduction by N. David Mermin.
2. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to access the quantum computing services provided by IBM, and other quantum computing services Simulators.

CO2: Able to think independently of quantum circuits, algorithm and applications for real-time stochastic problems in QC.

CO3: Trained to design QC circuits and reversible logics for real world problems.

CO4: Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.

CO5: Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Machine Learning Techniques**
Course Code: MCA-054	**Title: Machine Learning Techniques**

Course Objectives:

CO1: To understand the need for machine learning for various problem solving
CO2 To understand a wide variety of learning algorithms and how to evaluate models generated from data
CO3: To understand the latest trends in machine learning
CO4: To design appropriate machine learning algorithms and apply the algorithms to a real-world problems
CO5: To optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**INTRODUCTION**– Learning, Types of Learning, Well defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning, Decision Tree Learning, Bayesian networks, Support Vector Machine, Genetic Algorithm), Issues in Machine Learning and Data Science Vs Machine Learning;	08
II	**REGRESSION:** Linear Regression and Logistic Regression **BAYESIAN LEARNING-** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. **SUPPORT VECTOR MACHINE:** Introduction, Types of support vector kernel– (Linear kernel, polynomial kernel, and Gaussian kernel), Hyper plane – (Decision surface), Properties of SVM, and Issues in SVM.	08
III	**DECISION TREE LEARNING-** Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. **INSTANCE-BASED LEARNING** – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.	08
IV	**ARTIFICIAL NEURAL NETWORKS**– Perception's, Multilayer perception, Gradient descent and the Delta rule, Multilayer networks,	08

	Derivation of Back propagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; **DEEP LEARNING** - Introduction, concept of convolutional neural network , Types of layers – (Convolutional Layers , Activation function, pooling , fully connected), Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for eg on Diabetic Retinopathy, Building a smart speaker, Self-deriving car etc.	
V	**REINFORCEMENT LEARNING**–Introduction to Reinforcement Learning , Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process, Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Q Learning. **GENETIC ALGORITHMS:** Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications	08

Text Book:

1. Tom M. Mitchell,—Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin,—Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press 2004.
3. Stephen Marsland,—Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

Reference Book:

1. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
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	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Learn the basics of learning problems with hypothesis and version spaces
CO2: Understand the features of machine learning to apply on real world problems
CO3: Characterize the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning
CO4: Analyze the concept of neural networks for learning linear and non-linear activation functions
CO5: Learn the concepts in Bayesian analysis from probability models and method.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Machine Learning Techniques**
Course Code: MCA-054	**Title: Machine Learning Techniques**

Course Objectives:

CO1: To understand the need for machine learning for various problem solving
CO2 To understand a wide variety of learning algorithms and how to evaluate models generated from data
CO3: To understand the latest trends in machine learning
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II	**REGRESSION:** Linear Regression and Logistic Regression **BAYESIAN LEARNING:** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. **SUPPORT VECTOR MACHINE:** Introduction, Types of support vector kernel– (Linear kernel, polynomial kernel, and Gaussian kernel), Hyper plane – (Decision surface), Properties of SVM, and Issues in SVM.	08
III	**DECISION TREE LEARNING:** Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. **INSTANCE-BASED LEARNING:** k-Nearest Neighbour Learning,	08

	Locally Weighted Regression, Radial basis function networks, Case-based learning.	
IV	**ARTIFICIAL NEURAL NETWORKS:** Perception's, Multilayer perception, Gradient descent and the Delta rule, Multilayer networks, Derivation of Back propagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; **DEEP LEARNING:** Introduction, concept of convolutional neural network, Types of layers – (Convolutional Layers, Activation function, pooling, fully connected), Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for eg on Diabetic Retinopathy, Building a smart speaker, Self-deriving car etc.	08
V	**REINFORCEMENT LEARNING**: Introduction to Reinforcement Learning, Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process, Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Q Learning. **GENETIC ALGORITHMS:** Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications	08

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5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Learn the basics of learning problems with hypothesis and version spaces
CO2: Understand the features of machine learning to apply on real world problems
CO3: Characterize the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning.
CO4: Analyze the concept of neural networks for learning linear and non-linear activation functions
CO5: Learn the concepts in Bayesian analysis from probability models and method.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Quantum Computing**
Course Code: MCA-055	**Title: Quantum Computing**

Course Objectives:

CO1: Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.

CO2 Demonstrate an understanding of a quantum computing algorithm by simulating it on a classical computer, and state some of the practical challenges in building a quantum computer.

CO3: Contribute to a medium-scale application program as part of a co-operative team, making use of appropriate collaborative development tools (such as version control systems).

CO4: Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.

CO5: Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
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III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	08
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum	08

	noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	
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Text Book:

1. Micheal A. Nielsen. & Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.
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	Max. Marks 100
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Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to access the quantum computing services provided by BM, and other quantum computing services Simulators.

CO2: Able to think independently of quantum circuits, algorithm and applications for real-time stochastic problems in QC.

CO3: Trained to design QC circuits and reversible logics for real world problems.

CO4: Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.

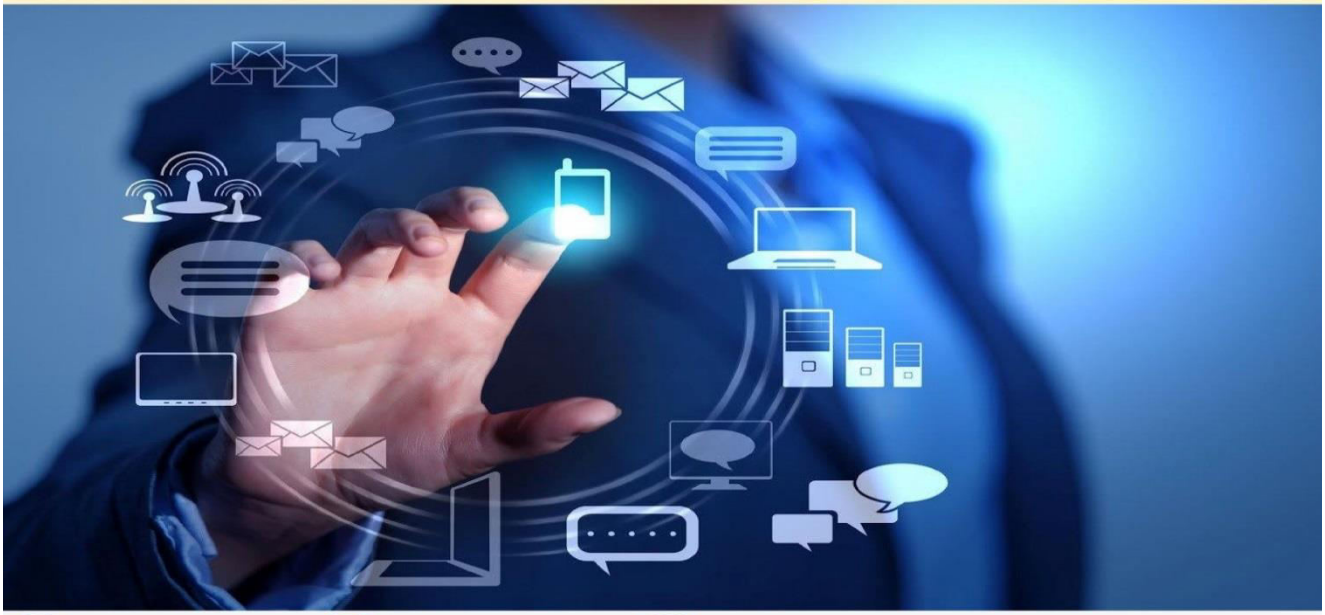
CO5: Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.

IIMT UNIVERSITY MEERUT
Transforming Education System, Transforming Lives
UGC Approved Section 2(f) & 12B
NAAC Accredited with A GRADE

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SCHOOL OF COMPUTER SCIENCE & APPLICATIONS

ACADEMIC HAND BOOK



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Ordinance & Academic Regulations
For Master of Computer Applications (MCA (AI&ML))
(Established by Govt. of U.P. Vide U.P act No.32 of 2016)
(Academic Session: 2025-26)

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DEFINITIONSANDNOMENCLATURE:

(i) "**Programme**" means Post Graduate Degree Programme like Master of Computer Application (MCA). Hence further MCA and MCA (AI & ML) will call MCA in this document. AI means Artificial Intelligence and ML means Machine Learning.

(ii) **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.

(iii) **Semester:** Each semester will consist of 15-18 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be scheduled from **July to December** and even semester from **January to June**.

(iv) **Program:** An educational program leading to award of a degree.

(v) "**VC**, Vice-Chancellor of IIMT-University" means the Head of the University.

(vi) **Course:** Usually referred to, as 'papers' is a component of a program. All courses need not carry the same weightage. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/tutorials/laboratory work/field work/ outreach activities/project work/ vocational training/viva/ seminars/term papers/assignments/ presentations/ self-study etc. or a combination of some of these.

(vii) **Branch:** Master of Computer Applications (MCA).

(viii) **Letter Grade:** It is an index of the performance of students in a said course. Grades are denoted by letters A, B, C, D, E and F.

(ix) **Grade Point:** It is a numerical weightage allotted to each letter grade on a 10-pointscale.

(x) **Credit:** A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

(xi) **Credit Point:** It is the product of grade point and number of credits for a course.

(xii) **Semester Grade Point Average (SGPA):** It is a measure of academic performance of student/s in a semester. It is thereto of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

(xiii) **Cumulative Grade Point Average (CGPA):** It is a measure of overall cumulative performance of a student over all semesters. The CGPA is the ratio of total credit points earned by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

(xiv) **First Attempt:** If a student has completed all formalities and become eligible to attend the examinations and has attended at least one subject of passing, such attempt (first sitting) shall be considered as first attempt.

(xv) **Transcript or Grade Card or Certificate:** Based on the grades earned, a grade sheet/certificate shall be issued to all the registered students at the end of every academic year. The grade sheet/certificate will display the course details (code, title, number of credits, grade secured) along with SGPA of both semesters and CGPA earned till that academic year.

(xvi) **UGC:** University Grants Commission.

(xvii) **AIU:** Association of Indian universities

The CBCS provides choice for students to select from the prescribed courses. Sequencing Plan for the **MCA** Post Graduate Degree Curriculum

Semesters Course Coverage

I–II Foundation Course for Computer Applications and Programming Techniques, Mathematical Foundations, Numerical & Statistical Techniques and Course on Computer Organizations and Entrepreneurial Skills etc.

III-IV Core Courses including Design & Development of Applications, Design& Analysis of

Algorithms, Operating Systems, Applications of Information Systems, Web Application Development, Artificial Intelligence, Elective Courses, Mini Project Work etc.

1. PREAMBLE

As the technological enhancement and availability of technology to every person of world a huge demand of computer skilled professional is ample. In this world of opportunities, impact of higher education is so inevitable for getting desired guidance to secure, right kind of employment. It is compulsory to pursue higher related- education in the best institutes. The syllabus development is a step to ensure development of the undergraduates for both, academia and employability. Latest technical trends, industry standards, market needs, and interests of students, future expectations the need has been taken into consideration while developing the syllabus.

This is an effort to develop a student centric framework where they are expected to have a concrete understanding of fundamentals of computer science along with the latest trends and techniques like Artificial Intelligence, Internet of Things (IoT), Machine Learning (ML) with advanced skill sets that include Mobile Application environment, Object Oriented Programming (OOPs) among many courses. Each course aims to present learning targets and objectives, and thus provide learning and teaching strategies, assessment and resources. The students shall be equipped with the latest trends in computer science, after completion of the programme.

With this an education temple of nation should ensure an environment, which should be bias free, irrespective of cast, religion, races, sex difference and easily available to youths of the nation. The human value, ethics and environmental teaching is also introduced with this.

2. VISION AND MISSION OF THE SCHOOL

VISION

To achieve heights in computer education domain by creating appropriate environment for students, faculties and staff with availability of latest technological infrastructure.

MISSION

1. To dissipate appropriate all types of practical and theoretical computer science knowledge to our young students.
2. Inculcate professional efficiency in the students for brighter career opportunity as per industry latest requirement.
3. To provide learning environment for students with our reputed academics partner in the field of computer science.
4. To prepare our student as an IT professional with full of ethics and human values.

3. PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: The Postgraduates Programs are designated to produce skilled Postgraduates who will be proficient professionals in private sector, semi government and government institutions.

PEO2: The pass out Postgraduates will be able to handle the overall world requirements and will become effective employees or employers.

PEO3: The pass out Postgraduates will be a good team leader and will be able to lead the team to find inexpensive and optimal solutions and, achieve expertise in their fields or become entrepreneurs and play the proficiently managing roles in all types of institutions, establishment, and industry ventures.

4. PROGRAM OUTCOMES (PO'S)

PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and the need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. PROGRAM SPECIFIC OUTCOMES (PSO'S)

PSO1: The Postgraduates are capable in basic principles and methods of Computer era with sufficient Mathematical and Scientific grounds and can:

- Apply fundamental concepts of integration, Artificial intelligence with deep learning, differentiation, vector calculus, probability & statistics, and discrete mathematics.
- Design, create & evaluate programming algorithms appropriate to all types of current real frequent changing difficulties.

PSO2: The Postgraduates have deep sense acknowledgement for:

- Present capability for computers, computer network and server environments and their troubleshooting.
- Capacity to handle ever changing cloud computing environments and related solutions.

- Well defined knowledge for solving problems of security and threats in knowledge and financial domain.

6. ADMISSION

6.1 Admission to MCA first year in Ist Semester.

6.2 Admission on migration of a candidate from any other University to the University is not permitted.

7. ELIGIBILITY FORADMISSIONS

7.1 Admission to MCA First Year:
For admission to first year of MCA in IIMT University, Meerut, a candidate must have passed Bachelor degree course of 03 Years minimum duration from any recognized Indian University; or its equivalent, recognized by **A.I.U.** securing minimum 50% (45% for SC/ST) marks in aggregate. Candidate must have passed Mathematics at 10+2 level or Graduation level.

7.2 The Academic Council shall have power to amend or repeal the eligibility criteria laid down at clause 7.1 as per the guidelines of AICTE.

8. ATTENDANCE

8.1 Every student is required to attend all the Lectures, Tutorials, Practical Classes and other prescribed curricular and co-curricular activities. The attendance can be condoned up to 25% on medical grounds or for other genuine reasons beyond the control of students.

8.2 A further relaxation of attendance up to 15% for a student can be given by Head of School/College provided that he/she has been absent with prior permission of the Head of the School/college for the reasons acceptable to him.

8.3 No student will be allowed to appear in the end semester examination if he / she do not satisfy the overall average attendance requirements of Clause Nos. 8.1, and 8.2. Such candidate(s) shall be treated as having failed and will be further governed by clause no. 9.2 &9.3.

8.4 The attendance shall be counted from the date of admission in the college or start of academic session whichever is later.

9. DURATION OFCOURSE

9.1 Total duration of the MCA Course shall be 2 years, each year comprising two semesters. Each semester shall normally have teaching for the 90 working days or as prescribed by A.I.C.T.E. from time to time.

9.2 The student admitted to 1st year MCA Course shall complete the course within a period of five (05 Years) Academic Years from the date of first admission, failing which he/she has to discontinue the course.

9.3 A Student, who has failed twice in first year due to any reason (either due to his/her non-appearance or he/she being not permitted to appear in semester examinations) shall not be

allowed to continue his/her studies further. Provided further that if a student wishes to continue third time in first year, he/she may be allowed on the terms and conditions laid down by the University for such permission but the maximum time allowed for completing the course will remain the same as described in clause 4.2.

9.4 The minimum percentage requirement for MCA Degree is 40%.

10. CURRICULUM

10.1 The 2 Year curriculum has been divided into 4Semesters and shall include Lectures, Tutorials, Practical Labs, Seminars and Projects etc. in addition to industrial training as defined in the scheme and executive instructions issued by the University from time to time.

10.2 The curriculum will also include other curricular, co-curricular and extracurricular activities as may be prescribed by the University from time to time.

10.3 The subjects listed in semester I or II for MCA will be as per Course Structure of MCA Program and shall not be offered exactly in the same sequence.

11. EXAMINATION

11.1 The performance of a student in a semester shall be evaluated through continuous class assessment and end semester examination. The continuous assessment shall be based on class tests, assignments/tutorials, quizzes/viva-voce and attendance. The marks for continuous assessment (Sessional marks) shall be awarded at the end of the semester. The end semester examination shall be comprised of written papers, Practical and Viva-voce, Record of Lab Work, Project Work, Design Reports or by means of any combination of these methods.

11.2 The distribution of marks for sessional, end semester theory papers, practical and other examinations, seminar, project and industrial training shall be as prescribed by the University in prescribed Course Structure. The practical, viva-voce, projects and reports shall be examined/evaluated through internal and external examiners as and when required, as per university guidelines.

11.3 The marks obtained in a subject shall consist of marks allotted in end semester theory paper and sessional work.

12. ELIGIBILITY OFPASSING

12.1 A student who obtained Grades A^+ to E shall be considered as passed. If a student secured "F" grade, he /she has to reappear for the examination**.** It is mandatory for a student to earn the required credits as mentioned in each semester.

(a) For a pass in a Theory Subject, a student shall secure minimum of 30% of the maximum marks prescribed in the University Examination and 40% of marks in the aggregate marks in the subject including sessional marks. i.e., Minimum Passing Grade is "E".

(b) For a pass in a Practical/Project/Viva-voce examination, a student shall secure a minimum of 50% of the maximum marks prescribed for the University Examination in the relevant Practical/Project/Viva-voce and 40% of marks in the aggregate marks in

the Practical/Project/Viva-voce including sessional marks i.e., Minimum Passing Grade in a course is "E".

12.2 The students who do not satisfy the condition 12.1 or the student who remains absent shall be deemed to have failed in that subject and may reappear for the University examination in the subsequent examinations. However, the Sessional marks awarded to the student/s at previous attempt in the concerned subject will be carried forward.

12.3 A student may, at his/her desire, opt to abandon his/her performance of a semester in following manner.

(a) A student may opt to abandon his/her performance only in University Examination of the Semester.

(b) A student may opt to abandon his/her Total Performance of the Semester which includes performance in University Examination and Sessional Marks.

(c) A student may opt to abandon his/her performance in University Examination of any or both semesters of the same academic year only.

(d) A student shall be allowed to abandon the performance maximum twice during the entire course of study.

(e) Performance of a semester, once abandoned, cannot be claimed again.

12.4 The student, who opts to abandon the performance of a semester as per clause 12.3, shall abandon performance in all the courses of that semester, irrespective of the fact whether the student has passed or failed in any subject of that semester.

12.5 A student, who opts to abandon the total performance of the semester including sessional marks, has to take readmission for the relevant semester. Readmission to the First semester in such cases shall not be considered as fresh admission i.e., the student will continue to have the same University Roll Number, which was allotted earlier.

12.6 The student, who opted to abandon his / her performance only in the University examination of a semester and does not desire readmission, shall be permitted to re-appear for examinations of all the subjects of the semester in the subsequent examinations as an Ex- Student. However, the sessional marks obtained by the student in the abandoned semester shall be retained.

12.7 Such students who opted to abandon the performance at final year are eligible for the award of Class and Distinction at the MCA degree level, but are not eligible for the award of ranks.

12.8 The student who passes a course of a semester as per 12.1 shall not be allowed to appear for the same again, unless he/she opts for *abandoning of results* as per12.3-12.7.

12.9 A student shall be declared to have completed the program of MCA degree, provided the student has undergone the stipulated course work as per the regulations and has overall 40 percent marks.

13. ELIGIBILITYFORPROMOTION

13.1 There shall not be any restriction for promotion from an odd semester to the next even semester.

13.2 For promotion from even semester to the next odd semester (i.e., of the next academic year) the student has cleared in at least seven subjects in the immediately preceding two semesters including theory and practical exam.

13.3 The result of the semester shall be declared pass only on securing E or above grades in all subjects and minimum Semester Grade Point Average (SGPA) is5.0.

13.4 Student himself can decide to abandon the performance of any or both the semesters of same academic year as per clause 8.3 and reappear in abandoned semester examination as per clauses 7.4, 7.5 &7.6.

13.5 Grace Marks:

13.5.1 A candidate may be awarded grace marks a maximum of total 10 marks distributed in maximum four subjects, not more than 5 marks in an individual subject, including theory papers, practical, seminar, project and/or aggregate marks in each academic year provided he/she can be declared to have passed the academic year by the award of these marks.

13.5.2 The grace marks shall not be added to the aggregate marks.

14. CARRYOVERSYSTEM

14.1 Following rules shall be followed for carry over papers:

(a) A candidate who satisfies the requirements of clause 12.2 (a) will be required to appear in those theory papers / practical's during respective end semester exams in which he/she failed.

(b) A candidate satisfying clause 12.2 (b) shall be required to exercise his/her choice of theory papers in which he/she desires to appear in the examination to fulfill the requirements of clause12.1(a).

(c) A candidate shall be required to exercise his/her choice of minimum theory papers in which he/she desires to appear in the examination for improvement to fulfill the requirements of clause13.3.

(d) Candidate appearing for carry over paper in any semester shall be examined with the examination paper of that subject running in that semester.

14.2 All carryover examinations shall be held only with end semester examination.

15. RE-ADMISSION IN THE SCHOOL/ COLLEGE

A candidate may be allowed for re-admission provided he/she satisfies one of the following conditions:

(a) A candidate is declared fail.

(b) A candidate did not appear in a semester examination / or he/she was not granted permission to appear in the examination.

(c) A candidate has been detained by the institute and subsequently has been permitted to take re-admission.

(d) A candidate has own desire to abandon the performance of semester(s).

16. COMPUTATION OF SGPA ANDCGPA

16.1 The IIMT University Meerut adopts absolute grading system wherein the marks are converted to grades, and every semester results will be declared with semester grade point average (SGPA) and Cumulative Grade Point Average (CGPA). The CGPA will be calculated every semester, except the first semester. The grading system is with the following letter grades and grade points scale as given below:

Level	Outstanding	Excellent	Very Good	Good	Above Average	Average	Poor	Fail
Letter Grade	A+	A	B+	B	C	D	E	F
Grade Points	10	9	8	7	6	5	4	00
Score (Marks) Range (%)	≥ 90 (90-100)	<90 (80-89)	<80, ≥70 (70-79)	<70, ≥60 (60-69)	<60 ≥50 (50-59)	<50, ≥45 (45-49)	<45, ≥40 (40-44)	< 40 (0-39)

16.2 A student obtaining Grade "F" shall be considered failed and will be required to reappear in the examination. Such students after passing the failed subject in subsequent examination/s will be awarded with "E" grade irrespective of marks he/she scores in the subsequent examination/s. Number of attempts taken to clear a subject/s shall be shown in the transcripts.

16.3 The University has right to scale/moderate the theory exam/practical exam/sessional marks of any subject whenever required for converting of marks in to letter grades on the basis of the result statistics of university as in usual practice.

(a) The modality for moderation of marks before the declaration of result shall be decided by a committee of Pro-Vice Chancellor, Dean UG, Assoc. Dean UG and Controller of Examination.

(b) The modality for moderation of marks if needed after the declaration of result shall be decidedbyacommitteeofPro-ViceChancellor,DeanUG,Assoc.DeanUG,Controllerof Examination and an external member not below the rank of Professor nominated by the Vice Chancellor.

(c) If the candidate(s) appeared in the examination but theory marks are not available due to missing of copy by any reason, the average marks may be awarded as decided by the committee mentioned in 16.3(a). In case of missing/unavailable of sessional marks, Controller of Examination can take decision as per the provision laid down by the Examination Committee.

(d) The Committee defined in16.3 (a) shall also fix up the responsibility and recommend the punishment for occurrence of such case(s) in16.3(c).

(e) All the matters defined under 15.3(a) to 15.3 (d) shall be executed subject to the approval of Academic Council of the IIMTU.

16.4 Computation of SGPA and CGPA

The following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

(a) The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student ,i.e.

$$SGPA\ (S_i) = \Sigma(C_i \times G_i) / \Sigma C_i$$

Where C_i is the number of credits of the $\mathbf{i^{th}}$ course and Gi is the grade point scored by the student in the $\mathbf{i^{th}}$ course.

(b) The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme ,i.e.

$$\mathbf{CGPA} = \Sigma (C_i \times S_{i)} / \Sigma C_i$$

Where Si is the SGPA of the i^{th} semester and Ci is the total number of credits in that semester.

(c) The SGPA and CGPA shall be rounded off to 2 decimal places and reported in the transcripts.

Illustration for Computation of SGPA and CGPA Computation of SGPA Illustration No.1

Course	Credit	Grade letter	Grade point	Credit Point (Credit × Grade)
Course 1	4	B^+	8	4×8 = 32
Course 2	4	C	6	4×6 = 24
Course 3	4	B	7	4×7 = 28
Course 4	3	A+	10	3×10= 30
Course 5	3	D	4	3×4 = 12
Course 6	2	C	6	2×6 = 12
Course 7	2	A	9	2×9 = 18
Course 8	2	C	6	2×6 = 12
Total	**24**			**168**

Thus, **SGPA= 168/24=7.00**

Illustration No.2

Course	Credit	Grade letter	Grade point	Credit Point (Credit × Grade)
Course 1	4	B+	8	4×8 = 32
Course 2	4	C	6	4×6 = 24
Course 3	4	B	7	4×7 = 28
Course 4	3	A+	10	3×10= 30
Course 5	3	F	0	3×0= 00
Course 6	2	C	6	2×6 = 12
Course 7	2	A	9	2×9 = 18
Course 8	2	C	6	2×6 = 12
Total	**24**			**156**

Thus, **SGPA= 156/24=6.50**

Illustration No.2 (a)

Course	Credit	Grade letter	Grade point	Credit Point (Credit ×Grade)
Course 1	3	E	4	3×4 = 12

C_i (First Attempt)156+C_i (subsequent attempt)12= 168

Thus, **SGPA= 168/24=7.00**

Illustration No.3

Course	Credit	Grade letter	Grade point	Credit Point (Credit × Grade)
Course 1	4	B+	8	4×8 = 32
Course 2	4	C	6	4×6 = 24
Course 3	4	B	7	4×7 = 28
Course 4	3	A+	10	3×10= 30
Course 5	3	A	9	3×9= 27
Course 6	2	C	6	2×6 = 12
Course 7	2	A	9	2×9 = 18
Course 8	2	C	6	2×6 = 12
Total	**24**			**183**

Thus, **SGPA= 183/24=7.63**
CGPA= 24x7.00+24x7.63/48=7.3125
CGPA after Final Semester

Sem.- 1	Sem. - 2	Sem. - 3	Sem. – 4
Credit: 24	Credit: 24	Credit: 27	Credit: 27
SGPA:7	SGPA:8.5	SGPA:9.2	SGPA:6.86

Thus**, CGPA**=24*x*7 + 24*x*8.5 + 27*x*9.2 + 27*x*6.86 + 24*x*8.18 + 24*x*7.73 **=7.92**

16.5 **Transcript (Format):** Based on the above recommendations on Letter grades, grade points, SGPA and CCPA, the transcript for each semester and a consolidated transcript indicating the performance in all semesters may be issued.

17. CONVERSION OF GRADES INTOPERCENTAGE

Conversion formula for the conversion of CGPA into Percentage is
CGPA Earned x 10= Percentage of marks scored.
Illustration: CGPA Earned 7.92 x 10 = 79.2%

18. AWARD OF DIVISION, RANKANDMEDALS

18.1 Division shall be awarded only after the final semester examination based on integrated performance of the candidate for all the six semesters (four semesters for lateral entry) as per following details.

(a) A candidate who qualifies for the award of the degree securing E or above grades in all subjects pertaining to all semesters in his/her first attempt within six consecutive semesters (three academic years)/ four consecutive semesters (two academic years) as applicable, and in addition secures a CGPA of 7.5 and above for the semesters I to VI and in case of lateral entry (III to VI) shall be declared to have passed the examination in FIRST DIVISION WITHHONOURS.

(b) A candidate who qualifies for the award of the degree by securing E or above grades in all subjects of all the semesters within a maximum period of six semesters/four semesters as applicable, after his/her commencement of study in the 1st/3rd semester and secures CGPA not less than 6.5 shall be declared to have passed the examination in **FIRST DIVISION**.

(c) All other candidates who qualify for the award of degree by securing E or above grades in all subjects of all semesters within a maximum period of six / four semesters as applicable, after his/her commencement of study in the 1st/3rdsemester an addition secures CGPA not less than 5.0 shall be declared to have passed the examination in **SECOND DIVISION**.

18.2 For award of ranks a minimum of 10 students should have appeared in the 4th semester examination. The total number of ranks awarded shall be 10% of total number of students appeared in 6th semester or 10 students, whichever isless.

Illustration:

1. If 100 students appeared for the 4th semester in MCA, the number of ranks to be awarded for MCA will be 10.
2. If 90 students appeared for the 4thsemester in MCA, the number of ranks to be awarded for MCA will be 09.

For award of rank in MCA, the CGPA secured by the student from

(a) 1stto 6th semester for the students admitted to MCA. Program from 1st year, And A student shall be eligible for a rank at the time of award of degree in MCA, provided the student

(b) Has passed 1stto 4th (students joining from 1stsemester) semester in all the subjects in first attempt only

(c) Has not repeated/rejected any of the lower semesters.

If two students get the same *CGPA*, the tie should be resolved by considering the number of times a student has obtained higher *SGPA;* but, if it is not resolved even at this stage, the number of times a student has obtained higher grades like A^+, A, B^+, B etc. shall be taken into account in rank ordering of the students in a program.

18.3 The Gold, Silver and any other Medals as decided by the university shall be awarded to student's falls in the top ranks of various courses as per university rules.

19. SCRUTINY ANDREVALUATION

19.1 Scrutiny shall be allowed in only theory papers.

19.2 Revaluation of theory/practical papers is permitted only with certain conditions as laid down by university.

20. UNFAIRMEANS

Cases of unfair means shall be dealt as per the rules and regulations of the University.

21. AWARD OF SESSIONALMARKS

Sessional marks for theory subjects, practical and project shall be awarded as prescribed and at present the break-up of sessional marks shall be as follows:

(a) **Theory Subjects:**

(i) Class test which will comprise 20 % of total theory marks with two mid-term tests of equal weightage.

(ii) Teacher Assessment Tutorial/Assignment/ Quizzes/ Attendance comprises 10% of total theory marks.

(b) **Practical**:

(i) Two mid-term viva-voce/tests of equal weightage 30% of total Practical marks.
(ii) Teacher Assessment: Lab, Record/ Attendance 20%of total Practical marks.

(c) **Make-up test** may be held only for those students who could not appear in any one of mid-term class tests due to genuine reasons for which the prior permission from the Head of Institution/College was taken. Make up test shall ordinarily be held about two weeks before the semester examination. The syllabus for the make-up test shall be the whole syllabus covered by the subject teacher up to that time.

22. AWARD OF SEMINAR INDUSTRIAL TRAINING, EDUCATIONAL TOUR MARKS AT INSTITUTION/COLLEGELEVEL

22.1 The marks of Seminar, Industrial Training, Educational tour marks shall be awarded on the following basis:
(a) Write-up / Report 50%
(b) Presentation 50%

22.2 The marks in Seminar, Industrial Training and Educational Tour shall be awarded by a committee consisting of following members:
(a) Head of the Department or his/her nominee.
(b) Concerned Officer – In charge.
(c) Senior Faculty Member of the department nominated by the Head of Department.

23. CANCELLATION OFADMISSION

The admission of a student at any stage of study shall be cancelled if:
(i) He / She is not found qualified as per AICTE / State Government norms and guidelines or the eligibility criteria prescribed by the University. Or
(ii) He / She is found unable to complete the course within the stipulated time as prescribed in clause 4.2 or
(iii) He / She are found involved in creating indiscipline in the Institution / College or in the University.

24. STUDENT DISCIPLINE

Every student is required to observe utmost discipline and decorum both inside and outside the campus and not to indulge in any activity which may affect adversely the prestige reputation of the University and School.

25. RAGGING

Ragging in any form is a criminal and non-bailable offence in our country. The current State and Central legislations provide stringent punishments including imprisonment. Once the involvement of as student(s) is established in ragging, offending fellow students/staff, harassment of any nature to the fellow students/staff etc. the student(s) will be liable to be dismissed from the University, as per the laid down procedures of the UGC / Govt. /Institute. Every senior student at the University, along with their parent, shall give an undertaking every year in this regard and the same should be submitted at the time of Registration.

29. POWER TO MODIFY

Not with standing all that has been stated above, the Academic Council is vested with powers to modify any or all the above regulations from time to time, if required, subject to the approval by the Board of Studies and final approval by Vice-Chancellor.

Evaluation Scheme

MCA (AI & ML)
Year: I / Semester: I

S. No.	Subject Code	Subject Name	Course Type	Periods			Internal	External	Total	Credit
				L	T	P				
1.	MCA-111	Fundamental of Computers & Emerging Technologies	DSE	3	1	0	30	70	100	4
2.	MCA-112	Problem Solving using C	Core Theory	3	1	0	30	70	100	4
3.	MCA-118	Python Programming	Core Theory	4	0	0	30	70	100	4
4.	MCA-119	Probability & Statistics	DSE	4	0	0	30	70	100	4
5.	MCA-115	Computer Organization & Architecture	Core Theory	3	1	0	30	70	100	4
6.	MCA-116P	Problem Solving using C **Lab**	Core Practical	0	0	4	20	30	50	2
7.	MCA-117P	Computer Organization & Architecture **Lab**	Core Practical	0	0	4	20	30	50	2
8.	MCA-P1	Mini Project lab	Skill Enhancement Course	0	0	4	20	30	50	2
9.	ECC-111	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	0	0	25	0
10	ECC-112	University Social Responsibility	Skill Enhancement Course	0	0	0	0	0	25	0
11		Sports	Audit Course	0	0	0	50	0	50	0
		Total		**17**	**3**	**12**	**210**	**440**	**650**	**26**

MCA (AI & ML)
Year: I / Semester: II

S. No.	Subject Code	Subject Name	Course Type	Periods			Internal	External	Total	Credit
				L	T	P				
1.	MCA-128	Advanced Microsoft Excel with Tableau	**DSE**	4	0	0	30	70	100	4
2.	MCA-122	Object Oriented Programming	**Core Theory**	3	1	0	30	70	100	4
3.	MCA-129	LINUX ADMINISTRATION WITH SCRIPTING	**Core Theory**	3	1	0	30	70	100	4
4.	MCA-124	Database Management Systems	**Core Theory**	3	1	0	30	70	100	4
5.	MCA-125	Data Structures & Analysis of Algorithms	**DSE**	4	0	0	30	70	100	4
6.	MCA-126P	Object Oriented Programming **Lab**	**Core Practical**	0	0	4	20	30	50	2
7.	MCA-127P	DBMS LAB	**Core Practical**	0	0	4	20	30	50	2
8.	MCA-P2	Mini Project Lab	Skill Enhancement Course	0	0	4	20	30	50	2
9.	ECC-121	Industrial Visits/Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	0	0	25	0
10	ECC-122	University Social Responsibility	Skill Enhancement Course	0	0	0	0	0	25	0
11.		Sports	Audit Course	0	0	0	50	0	50	0
		Total		**17**	**3**	**12**	**210**	**440**	**650**	**26**

MCA (AI & ML)
Year: II / Semester: III

S. No.	Subject Code	Subject Name	Course Type	Periods			Internal	External	Total	Credit
				L	T	P				
1.	MCA-234	Machine Learning	Core Theory	3	1	0	30	70	100	4
2.	MCA-235	Advance Machine Learning	Core Theory	3	1	0	30	70	100	4
3.	MCA-233	Computer Network	Core Theory	4	0	0	30	70	100	4
4.		Elective–1	DSE	4	0	0	30	70	100	4
5.		Elective–2	DSE	3	1	0	30	70	100	4
6.	MCA-234P	Machine Learning	Core Practical	0	0	4	20	30	50	2
7.	MCA-235P	Advance Machine Learning	Core Practical	0	0	4	20	30	50	2
8.	MCA-P3	Mini Project lab	Skill Enhancement Course	0	0	4	20	30	50	2
9.	ECC-111	Industrial Visits/ Seminar or Presentation Based on the Report of Visits	Skill Enhancement Course	0	0	0	25	0	25	0
10	ECC-112	University Social Responsibility	Skill Enhancement Course	0	0	0	25	0	25	0
11		Sports	Audit Course	0	0	0	50	0	50	0
		Total		**17**	**3**	**12**	**310**	**440**	**750**	**26**

Elective-1	MCA011	Cryptography & Network Security
	MCA012	Data Warehousing & Data Mining
	MCA013	Software Project Management
	MCA014	Cloud Computing
	MCA015	Compiler Design
Elective-2	MCA021	Web Technology
	MCA022	Big Data
	MCA023	Simulation & Modeling
	MCA024	Software Testing & Quality Assurance
	MCA025	Digital Image Processing

MCA (AI & ML)
Year: II / Semester: IV

S. No.	Subject Code	Subject Name	Course Type	Periods			Internal	External	Total	Credit
				L	T	P				
1.		Elective – 3	DSE	3	0	0	30	70	100	3
2.		Elective – 4	DSE	3	0	0	30	70	100	3
3.		Elective – 5	DSE	3	0	0	30	70	100	3
4.	MCA-451	Project	Core Theory		-	-	200	500	700	14
		Total					**290**	**710**	**1000**	**23**

Elective-3	MCA031	Privacy & Security in Online social media
	MCA032	Soft Computing
	MCA033	Pattern Recognition
	MCA034	Data Analytics
	MCA036	Artificial Intelligence
Elective-4	MCA041	Block chain Architecture
	MCA042	Neural Network
	MCA044	Modern Application Development
	MCA045	Distributed Database Systems
Elective-5	MCA056	IOT
	MCA052	Computer Graphics and Animation
	MCA053	Natural Language Processing
	MCA054	Machine Learning
	MCA055	Quantum Computing

Format-3

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA(AI & ML)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Fundamental of Computers & Emerging Technologies**
Course Code: MCA - 111	**Title: Fundamental of Computers & Emerging Technologies**

Course Objectives:
CO1 Demonstrate the knowledge of the basic structure, components, features and generations of computers.
CO2: Describe the concept of computer languages, language translators and construct algorithms to solve problems using programming concepts.
CO3: Compare and contrast features, functioning & types of operating system and computer networks
CO4: Demonstrate architecture, functioning & services of the Internet and basics of multimedia.
CO5: Illustrate the emerging trends and technologies in the field of Information Technology.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Computer:** Definition, Computer Hardware & Computer Software **Components:** Hardware–Introduction, Input devices, Output devices, Central Processing Unit, Memory-Primary and Secondary. Software-Introduction, Types–System and Application. **Computer Languages:** Introduction, Concept of Compiler, Interpreter & Assembler **Problem solving concept:** Algorithms–Introduction, Definition, Characteristics, Limitations, Conditions in pseudo-code, Loops in pseudo code.	8
II	**Operating system:** Definition, Functions, Types, Classification, Elements of command based and GUI based operating system. **Computer Network:** Overview, Types (LAN, WAN and MAN), Data communication, topologies.	8
III	**Internet:** Overview, Architecture, Functioning, Basic services like WWW, FTP, Telnet, Gopher etc., Search engines, E-mail, Web Browsers. **Internet of Things (IoT):** Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.	8
IV	**Block chain:** Introduction, overview, features, limitations and application areas	8

	fundamentals of Block Chain. **Cryp to currencies:** Introduction, Applications and use cases. **Cloud Computing:** Itnature and benefits, AWS, Google, Microsoft & IBM Services.	
V	**Emerging Technologies:** Introduction, overview, features, limitations and application areas of Augmented Reality, Virtual Reality, rid computing, Green computing, Big data analytics, Quantum Computing and Brain Computer Interface	8

Text Books:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
2. Norton P., "Introduction to Computers", Mc Graw Hill Education.
3. Goel A., "Computer Fundamentals", Pearson.

Reference

1. Balagurusamy E., "Fundamentals of Computers", Mc Graw Hill.
2. Thareja R., "Fundamentals of Computers", Oxford University Press.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Demonstrate the use of mathematical software and solve simple mathematical problems.
CO2: Explain the needs of hardware and software required for a computation task.
CO3: State typical provisions of cyber law that govern the proper usage of Internet and computing resources.
CO4: Explain the working of important application software and their use to perform any engineering activity.
CO5: Demonstrate the use of Operating system commands and shell script.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA (AI &ML)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: PROBLEM SOLVING USING C**
Course Code: MCA - 112	**Title: PROBLEM SOLVING USING C**

Course Objectives:

CO1: Describe the functional components and fundamental concepts of a digital computer system including number systems.
CO2: Construct flow chart and write algorithms for solving basic problems.
CO3: Write simple programs using the basic elements like control statements, functions, arrays and strings.
CO4: Write advanced programs using the concepts of pointers, structures, unions and enumerated data types.
CO5: Apply pre-processor directives and basic file handling and graphics operations in advanced programming.

Nature of Paper: CORE COURSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Basics of programming:** Approaches to problem solving, Use of high-level programming language for systematic development of programs, Concept of algorithm and flow chart, Concept and role of structured programming. **Basics of C**: History of C, Salient features of C, Structure of C Program, Compiling C Program, Link and Run C Program, Character set, Tokens, Keywords, Identifiers, Constants, Variables, Instructions, Data types, Standard Input / Output, Operators and expressions.	8
II	**Conditional Program Execution:** if, if-else, and nest edif-else statements, Switch statements, Restriction sons witch values, Use of break and default with switch, Comparison of switch and if-else. **Loops and Iteration:** for, while and do-while loops, Multiple loop variables, Nested loops, Assignment operators, break and continue statement. **Functions:** Introduction, Types, Declaration of a Function, Function calls, defining functions, Function Proto types, Passing arguments to a Function Return values and their types, writing multi-function program, Calling function by value, Recursive functions.	8
III	**Arrays:** Array notation and representation, declaring one-dimension a array,	8

	Initializing arrays, Accessing array elements, Manipulating array elements, Arrays of unknown or varying size, Two-dimensional arrays, Multi dimension a arrays. **Pointers:** Introduction, Characteristics, *and & operators, Pointer type declaration and assignment, Pointer arithmetic, Call by reference, Passing pointers to functions, array of pointers, Pointers to functions, Pointer to pointer, Array of pointers. **Strings:** Introduction, initializing strings, accessing string elements, Array of strings, Passing strings to functions, String functions.	
IV	**Structure:** Introduction, Initializing, defining and declaring structure, Accessing members, Operations on individual members, Operations on structures, Structure with in structure, Array of structure, Pointers to structure. **Union:** Introduction, Declaring union, Usage of unions, Operations on union. Enumerated data types **Storage classes**: Introduction, Types- automatic, register, static and external.	8
V	**Dynamic Memory Allocation**: Introduction, Library functions–malloc, calloc, real loc and free. **File Handling:** Basics, File types, File operations, File pointer, File opening modes, File handling functions, File handling through comm. And line argument, Record I/Oin files. **Graphics:** Introduction, Constant, Data types and global variables used in graphics, Library functions used in drawing, Drawing and filling images, GUI interaction within the program.	8

Text Books:

1. Kanetkar Y., "Let Us C", BPB Publications.
2. Hanly J. R. and Koffman E. B., "Problem Solving and Program Design in C", Pearson Education.
3. Schildt H., "C-The Complete Reference", Mc Graw-Hill.

Reference

1. Goyal K.K. and Pandey H.M., Trouble Free C", University Science Press
2. Gottfried B.,"Schaum's Outlines-Programming in C", McGraw-Hill Publications

Evaluation/Assessment Methodology

	Max. Marks: 100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report/Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Students will be able to develop programs based on fundamental concepts of programming in C.
CO2: Students will be able to solve problems based on Conditional and Iterative Control Statements.
CO3: Students will be able to learn Complete Programming Concepts of Arrays, Pointers and get familiar with modular programming Concepts of C using Functions.
CO4: Students will be able to learn conceptual programming with String, Structure and its differentiation with Union.
CO5: Students will be able to perform File handling programs with read and write concepts.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA(AI & ML)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Computer Organization & Architecture**
Course Code: MCA - 115	**Title: Computer Organization & Architecture**

Course Objectives:

CO1: Describe functional units of digital system and explain how arithmetic and logical operations are performed by computers.
CO2: Describe the operations of control unit and write sequence of instructions for carrying out simple operation using various addressing modes.
CO3: Design various types of memory and its organization
CO4: Describe the various modes in which IO devices communicate with CPU and memory.
CO5: List the criteria for classification of parallel computer and describe various architectural schemes.

Nature of Paper: CORE COURSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. **Processor organization:** general registers organization, stack organization and addressing modes.	8
II	**Arithmetic and logic unit:** Look ahead carries adders. Multiplication: Signed opera and multiplication, Booth's algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers.	8
III	**Control Unit:** Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc.), micro-operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: micro-program sequencing, concept of horizontal and vertical micro programming.	8
IV	**Memory:** Basic concept and hierarchy, semiconductor RAM memories, 2D & 21/2Dmemory organization. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary	8

	memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.	
V	**Input/Output:** Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.	8

Text Books:

1. John P. Hayes, "Computer Architecture and Organization", McGraw Hill.
2. William Stallings, "Computer Organization and Architecture-Designing for Performance", Pearson Education.
3. M. Morris Mano, "Computer System Architecture", PHI.

Reference

1. David A. Patterson and John L. Hennessy, “Computer Architecture-A Quantitative Approach”, Elsevier Pub.
2. Tannenbaum, "Structured Computer Organization", PHI.

Evaluation/Assessment Methodology

	Max. Marks100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: For a microprocessor system, student should be able to deal with the internal architecture of 8 bits and 16-bit microprocessor to analyze the working operation and to know the pin configuration for the respective microprocessor. A student should be good enough to deal with interrupts internally or externally.

CO2: He/she should be able to understand the basic concepts of Assembly language programming. For a particular data instruction set, student should be having a clear idea of solving machine language programs using kit. He/she shall be having an idea to tackle with counter delays and subroutines.

CO3: He/she should be able to know the concept of pipelining and parallelism in uniprocessor system for hazard detection. Understand the basic concept of Parallel computing.

CO4: A student should have a basic idea of job levels that are governed by an organization on priority basis. He/she should know the Pipeline scheduling theory.

CO5: For good networking, a student should be able to draw SIMD interconnections and FFTr a butterfly method system for collision prevention and vector dispatching. He/she should be able to make Cube Interconnection Network, Shuffle-Exchange and Omega Network

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Program: Degree **Class: MCA(AI &ML)**	**Year: I** **Semester: I**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Problem-Solving using C Lab**
Course Code: MCA -116P	**Title: Problem-Solving using C Lab**

Course Objectives:

CO1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.
CO2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements.
CO3: Students will be familiar with the concept of Arrays, Pointers, Functions, categories of function, and recursion.
CO4: Students will be able to develop a Program with Structure; learn Union and Complete String Operations.
CO5: Students will be familiar with File handling programs to perform read-write operations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a program to display "hello world" in C.	02
II	Write a program to find the largest and smallest among three entered numbers and also display whether the identified largest/smallest number is even or odd.	02
III	Write a program to check whether the entered year is a leap year or not (a year is a leap if it is divisible by 4 and divisible by 100 or 400.)	02
IV	Write a program to read a string and check for palindrome without using string-related functions (a string is a palindrome if its half is mirror by itself.	02
V	Write a program to find the biggest among three numbers using a pointer.	02
VI	Create a structure named company which has a name, address, phone, and as member variables. Read the name of the company, its address, phone, and no Of Employee. Finally display these members' values.	02
VII	The BCT class and display the details from the function.	02
VIII	Write a program to show programming examples with unions and structures.	02

Reference / Text Books:

❖ The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie. ❖ C Programming: A Modern Approach" by K. N. King.

Evaluation/Assessment Methodology	
	Max. Marks:50
1) Class tasks/ Sessional Examination	10
2) Presentations /Seminar	10
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	-
5) ESE	30
Total:	**50**

Program Learning Outcomes:

CO1: Students will be able to develop programs based on fundamental concepts of programming in C.

CO2: Students will be able to solve problems based on Conditional and Iterative Control Statements.

CO3: Students will be able to learn Complete Programming Concepts of Arrays, Pointers and get familiar with modular programming Concepts of C using Functions.

CO4 Students will be able to learn conceptual programming with String, Structure, and its differentiation with Union.

CO5: Students will be able to perform File handling programs with read and write concepts

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Program: Degree **Class: MCA(AI & ML)**	**Year: I** **Semester: I**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Computer Organization & Architecture Lab**
Course Code: MCA -117P	**Title: Computer Organization & Architecture Lab**

Course Objectives:
CO1: Design and verify combinational circuits (adder, code converter, decoder, multiplexer) using basic gates.
CO2: Design and verify various flip-flops.
CO3: Design I/O system and ALU.
CO4: Demonstrate combinational circuit using simulator.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit
(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Implementing HALF ADDER, FULL ADDER using basic logic gates	02
II	Implementing Binary-to-Gray, Gray-to-Binary code conversions.	02
III	Implementing 3–8-line DECODER. Implementing 4x1 and 8x1 MULTI PLEXERS.	02
IV	Verify the excitation tables of various FLIP-FLOPS	02
V	Design of an 8-bit Input / Output system with four 8-bit Internal Registers.	02
VI	Design of an 8-bit ARITHMETIC LOGICUNIT.	02
VII	Design the data path of a computer from its register transfer language description.	02
VIII	Design the control unit of a computer using either hardwiring or micro programming based on its register transfer language description.	02

Reference / Text Books:

1. John P. Hayes, "Computer Architecture and Organization", Mc Graw Hill.
2. William Stallings, "Computer Organization and Architecture-Designing for Performance", Pearson Education.

Evaluation/Assessment Methodology	
	Max. Marks:50
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report/Seminar On Research Project Report 5) ESE	10 - 10 - 30
Total:	**50**

Program Learning Outcomes:

CO1: Students will be able to develop flip-flops.
CO2: Students will be able to solve problems based on circuit design.
CO3: Students will be able to learn working of ALU.
CO4: Students will be able to Implement Binary -to -Gray, Gray-to -Binary code conversions
CO5: Students will be able to work with logic gates.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA(AI &ML)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Python Programming**
Course Code: MCA-118	**Title: Python programming**

Course Objectives:

1. Understand and use variables.
2. Work with common Python data types, like integers, floats, strings as well as pandas Data frames.
3. Use basic flow control including for loops and conditionals.
4. Read data from text files.
5. Obtain basic summary statistics from data files.

Nature of Paper: Core course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Getting Help, How To execute Python program, writing your first program, Pythoncoding Introduction, Python keywords and Identifiers, Python statements, Comments inpython, Getting user input, Variables, Data types, Numbers, Strings, Lists, tuples & Dictionary.	10
II	Control flow and syntax, if statement, Python operators, while Loop, Break and continue, for Loop, Pass statement, Introduction of function, calling Function, Function arguments, builtinfunction, scope of variables, Decorators, Passing function to a function, Lamb daexpression.	10
III	Modules and Packages, Importing Modules, Standard Modules-sys, Standard Modules-OS, the dir Function, Packages, Exception Handling, errors, Run Time Errors, handling IO Exception, Try…. except statement, Raise, Assert.	10
IV	Introduction to File Handling in Python, Files and Directories, writing data to a file, reading data from a file, Additional file methods, working with files, Working with Directories, pickle Module, Classes & Objects, Introduction of classes and objects, Creating Classes, Instance method, Special class method, Inheritance Method overriding, Data hiding.	10
V	Scientific Computing with Numpy, N-Dimensional Array Object, Array Slicing Method, Array reshaping methods, Numerical routines in Numpy, Introduction to Mat plot lib, Python 2D plotting, Plotting with default settings, Customizing mat plot lib Graphic with colors and line width,	10

	Generate plots, histograms, power spectra, Generate bar charts, scatter plots, introduction To Pandas, Pandas data structures and data analysis	

Text Books:

1. Python Cook book Author: By David Beazley and Brian K. Jones
2. The Python Book: The Ultimate Guide to Coding with Python by Aaron Asadi (ed.)
3. Functional Programming in Python Author: David Mertz

Reference:

1. Python-(Mark Lutz) Python Training guide (BPB Publications)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	20
2) Presentations/Seminar	-
3) Assignments	-
4) Research Project Report	10
Seminar On Research Project Report	70
5) ESE	
Total:	**100**

Prerequisites for the course: **NIL**

Course Learning Outcomes:

CO1: The course is designed to provide Basic knowledge of Python.
CO2: Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
CO3: Express proficiency in the handling of strings and functions.
CO4: Identify the commonly used operations involving file systems and regular expressions.
CO5: Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.

Format-3

IIMT UNIVERSITY
Year: I / Semester: I

Programme: Degree **Class: MCA (AI &ML)**	**Year: I** **Semester: I**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Probability & Statistics**
Course Code: MCA-119	**Title: Probability & Statistics**

Course Objectives:

CO1: Understand the concepts of curve and central tendency.
CO2 Understand the basic concepts of probability and events.
CO3: Formulate theorems about the concept of probability.
CO4: Solve the problem on mean and variance.
CO5: To classify the data based on different parameters.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Basics of Data Science:-** Defining Objective of study, Population(universe), collection of data-census, method of sampling, Tools of collecting data-questionnaire, telephonic conversation, emails, SMS, online surveys, Classification of Data-based on various parameters Age, income, gender, education etc., Tabulation of Data-Forming the tables for further Analysis. **Central Tendency: -** Basics of Normal Curve, Average and their needs-Mean (AM, GM, HM), Median, Mode, why always AM is used as Average generally, Vocational Averages-Quartiles, Deciles, Percentiles. **Dispersion of Data: -** Mean Deviation, Standard Deviation (rms value), Different Coefficient of Dispersion-Quartile deviation, Range, Standard Deviation, Combined Mean Combined Standard Deviation, Coefficient of variation & its Applications, Understanding Six-sigma Scale.	10
II	**To discuss parameters of Normal tendency of Data: ->Skewness& Kurtosis:-**Defining the Moments and Moment Generating Functions, Moments about Actual Meanor Arbitrary Origin, defining **SKEWNESS** as Horizontal distortion of Data-Karl. Pearson's coefficient of Skewness, Bowley's coefficient of Skewness, Skewness by methods of Moments, Defining **KURTOSIS** as Vertical	10

	distortion of Data-Platykurtic, Mesokurtic, Lep to kurtic curves, Understanding the Normal Curve through Skewness & Kurtosis.	
III	**Theory of Probability-1:-**Basics of Probability-Simple events, Sure events, impossible events, Compound Events, equally likely events, Exhaustive Events, Understanding the Sample Space, empirical definition of probability, Defining the logical connectives OR,IF THEN & AND in probability, Understanding OR-Addition Theorem of Probability-Mutually& Non-Mutually Exclusive events. **Theory of Probability-2:-** Conditional probability Theorem: Defining IF THEN, Understanding the compound events-Independent events, dependent (Non-Independent) Events, Multiplications Theorem of Probability, Understanding the Priori and Posterior events, Understanding the total Probability The theorem, Baye's Theoremandits applications, Bernoulli or Binomial approach of Probability. Or Binomial approach of Probability. **Theory of Probability-2:-**Defining Probability as Function of Random variable, Understanding the Discrete and continuous Random Variable, Probability Distribution Functions for discrete Random variable, Probability Distribution Functions for Discrete R and omvariable & its mean and Variance, Probability Density Functions for Continuous R and omvariable & its mean and Variance.	10
IV	**Discrete Theoretical Distributions:-**Binomial Theoretical Distributions and its Parameters, Poisson Theoretical Distributions and its Parameters, Applications of theoretical distribution to create expected frequencies. **Continuous Theoretical Distributions:-** Defining Normal (or Gaussian) Distribution-Understanding its characteristics mean & variance, Defining The standard normal Distribution-Understanding Area under Normal Curve, Understanding the Normalization of Data. **Correlation & Regression:-** Simple Correlation-Karl Pearson coefficient of Correlation, Spearmen's rank Correlation, Multiple & Partial Correlation, Regression Analysis- Least square Method, Fitting of Line, Fitting of Quadratic, Fitting of Exponential Regression Analysis, Logistic Regression-Sigmoid curves Analysis.	10
V	**Test of significance of samples:-** Elementary theory of Testing of Hypothesis-two types of errors, Small and Large Samples, various Test-Standard normal test, t-Test, F-test, Fishers z-Test, Chi-Square Test-For Test of goodness of fit of an Experiment, Test of independence of Attributes, Introduction of ANOVA. **Introduction of Linear Algebra(in Brief):-** Vectors & Scalars- Products, cosine law, Orthogonal vectors, linear combination, linear independence of vectors, Matrices-addition, Product, transpose, determinant, Identify matrix, Invertible matrix, Inverse, rank of Matrix, Trace, Spur, Popular Types of Matrices-Symmetric, Diagonal, Orthogonal, Orthonormal, Eigen values & Eigen Vectors. **Introduction of Topology (In Brief):-** Introduction of Metric spaces (Metric distances)-Various types of Metric.	10

Text Book: 1. "Fifty Challenging Problems in Probability with Solutions": By Frederick Mosteller. 2. "An Introduction to Probability Theory and Its Applications": By William Feller.	
Reference Book: 1. "Probability Statistics and Queueing Theory" by P Kandasamy	
Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**
Prerequisites for the course: **NIL**	
Course Learning Outcomes: CO1: Able to understand the discrete and continuous distributions. CO2: Able to understand the basic rules and theorems in probability. CO3: Able to solve the problems on mean and variance. CO4: Able to understand the key concepts of probability. CO5: Able to define various types of metrics.	

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA(AI&ML)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject:DATA BASE MANAGEMENT SYSTEM**
Course Code: MCA- 124	**Title:DATA BASE MANAGEMENT SYSTEM**

Course Objectives:

CO1: Explain the concept of features of a database system and its application and compare various types of data models.
CO2: Describe the E-R Models and Relational Database.
CO3: Explain the concept of SQL Commands, relational algebra, tuple calculus and domain calculus.
CO4: Explain the need of normalization and normalize a given relation to the desired normal form.
CO5: Analyze the different approaches of transaction processing and concurrency control.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.	8
II	**Relational data Model and Language:** Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL	8
III	**Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less joined compositions, normalization using FD, MVD, and JDs, alternative approaches to data base design.	8

IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializ ability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Dead lock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.	8
V	**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.	8

Text Books:

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill.
2. Date C J, "An Introduction to Database Systems", Addision Wesley.
3. Elmasri, Navathe, "Fundamentals of Database Systems", Addision Wesley.
4. O'Neil, "Databases", Elsevier Pub

Reference

1. Rama krishnan, "Database Management Systems", Mc Graw Hill.
2. Leon & Leon, "Database Management Systems", Vikas Publishing House.
3. Bipin C. Desai, "An Introduction to Database Systems", Gagotia Publications.
4. Majumdar & Bhattacharya, "Database Management System", Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: SQL

Course Learning Outcomes:

CO1: Describe the features of a database system and its application and compare various types of data models.
CO2: Construct an ER Model for a given problem and transform it into a relation database schema.
CO3: Formulate solution to a query problem using SQL Commands, relational algebra, tuple calculus and domain calculus.
CO4: Explain the need of normalization and normalize a given relation to the desired normal form.
CO5: Explain different approaches of transaction processing and concurrency control.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Degree **Class: MCA**	**Year: I** **Semester : II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject:Data structure and analysis of algorithms**
Course Code: MCA- 125	**Title:Data structure and analysis of algorithms**

Course Objectives:

CO1: Explain the concept of data structure, abstract data types, algorithms, analysis of algorithms and basic data organization schemes such as arrays and linked lists.
CO2: Describe the applications of stacks and queues and implement various operations on them using arrays and linked lists.
CO3: Describe the properties of graphs and trees and implement various operations such as searching and traversal on them.
CO4: Compare incremental and divide-and-conquer approaches of designingal go rithms for problems such assorting and searching.
CO5: Apply and analyze various design approaches such as Divide-and-Conquer, greedy and dynamic for problem solving.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to data structure:** Data, Entity, Information, Difference between Data and Information, Data type, Build in data type, Abstract data type, Definition of data structures, Types of Data Structures: Linear and Non-Linear Data Structure, Introduction to Algorithms: Definition of Algorithms, Difference between algorithm and programs, properties of algorithm, Algorithm Design Techniques, Performance Analysis of Algorithms, Complexity of various code structures, Order of Growth, Asymptotic Notations. **Arrays:** Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D, 2-D Array Application of arrays, Sparse Matrices and they're representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable.	8

II	**Stacks**: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Post fix Expressions, Evaluation of post fix expression, Iteration and Recursion-Principles of recursion, Tailrecursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoitowers. **Queues:** Operation son Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, D equeue and Priority Queue. **Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collisionre solution Techniques used in Hashing.	8
III	**Sorting:** Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time: Counting Sort and Bucket Sort. **Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component.	8
IV	**Trees:** Basic terminology used with Tree, Binary Trees ,Binary Tree Representation: Array Representation and Pointer (Linked List) Representation, Binary Search Tree, Complete Binary Tree, Extended Binary Trees, Tree Traversal algorithms: In-order, Preorder and Post-order, Constructing Binary Tree from given Tree Traversal, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search Tree. Threaded Binary trees, Huffman coding using Binary Tree, AVL Tree and B-Tree.	8
V	Divide and Conquer with Examples Such as Merge Sort, Quick Sort, Matrix Multiplication: Strassen's Algorithm Dynamic Programming: Dijikstra Algorithm, Bellman Ford Algorithm, All-pair Shortest Path: Warshal Algorithm, Longest Common Sub-sequence Greedy Programming: Primsand Kruskalalgorithm.	8

Text Books:

1. Cormen T.H., Leiserson C.E., Rivest R.L., and Stein C., "Introduction to Algorithms", PHI.
2. Horowitz Ellis, Sahni Sartaj and Rajasekharan S., "Fundamentals of Computer Algorithms", 2nd Edition, Universities Press.

Reference

1. Lipschutz, Data Structures With C-SIE-SOS, Mc Graw Hill
2. Samanta D,"Classic Data Structures", 2nd Edition Prentice Hall India.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report	10
Seminar On Research Project Report	

5) ESE	70
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Understand the concept of data structure and various algorithms. CO2: Able to analyze the performance of algorithms. CO3: Understand which algorithm or data structure to use in different scenarios. CO4: Use various data structures effectively in application programs. CO5: Understand various types of sorting and their algorithms.	

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA(AI &ML)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: LINUX ADMINISTRATION WITH SCRIPTING**
Course Code: MCA-129	**Title: LINUX ADMINISTRATION WITH SCRIPTING**

Course Objectives:

CO1: To understand and make effective use of Linux utilities and shell scripting language to solve problems
CO2: To implement in C some standard Linux utilities like mv, cp, ls, etc.
CO3: To Develop the skills the necessary for systems programming including file system programming, process and signal management and interposes communication
CO4: To develop the basic skills required to write network programs using sockets

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Linux History, overview, Principles, Getting started with GNOME and edit text files with gedit, Manage files graphically and access remote system with Nautilus, Getting help in graphical environment, Installation overview, directory structure, Installation Graphical, Configuring Local Services, date and time, Configuration of printer, Basic commands vi editor, manage users and groups.	10
II	Partition, Swap Creation Ivm, quota management and permanent mounting, Raid, Luks, Basic job control or cron use of helping command scp or ssh, filter command, Understand run levels.	10
III	Package installation with rpm, package installation with yum, usehard links, soft links, archives, Regular Expressions, Pipelines, and I/O Redirection, nfs, cifs and autofs, Ldap, Controlling Access to files, Analyzing and Storing Logs, Managing Processes, Tuning and Maintaining the Kernel, System Recovery Techniques, Enchance User Security, Apache Server.	10
IV	File Security with Gnupg, Route Network Traffic Secure Network Traffic, NTP Server Configuration, Web Server Additional Configuration, Basic SMTP Configuration, Caching-Only DNS Server, FTP, Squid, samba, dhcp, nis, pam, iptables, TCP Wrappers, Bash Scripting and tools, basic Shell Scripting, Graphical tools of Scripting (Zenity and dialogs)	10

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	20 - - 10 70
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Students will be able to understand the basic commands of Linux operating system and can write shell scripts. CO2: Students will be able to create file systems and directories and operate them. CO3: Students will be able to create processes background and fore ground etc. by fork() system calls CO4: Students will be creating shared memory segments, pipes, message queues and can exercise inter-process communication.	

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA (AI & ML)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Object oriented programming**
Course Code: MCA - 122	**Title: Object oriented programming**

Course Objectives:
CO1: Definition of Object-Oriented Programming techniques.
CO2: Apply Object Oriented Programming techniques using Java.
CO3: Solve the real-world problems using of Packages, Interfaces, and apply Exceptions handling and Threading concepts in Java.
CO4: Develop I/O and GUI applications in java.
CO5: Design Database applications and swing programming in Java.

Nature of Paper: CORE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Object Oriented Programming: objects, classes, Abstraction, Encapsulation, Inheritance, Polymorphism, OOP in Java, Characteristics of Java, The Java Environment, Java Source File Structure, and Compilation. Fundamental Programming Structures in Java: Defining classes in Java, constructors, methods, access specifies, static members, Comments, Data Types, Variables, Operators, Control Flow, Arrays.	8
II	**Inheritance, Interfaces, and Packages:** Inheritance: Super classes, sub classes, Protected members, constructors in sub classes, Object class, abstract classes and methods. Interfaces: defining an interface, implementing interface, differences between classes and interfaces and extending interfaces, Object cloning, inner classes. Packages: Defining Package, CLASS PATH Setting for Packages, Making JAR Files for Library Packages, Import and Static Import Naming Convention For Packages, Networking java.net package.	8
III	**Exception Handling, I/O**: Exceptions: exception hierarchy, throwing and catching exceptions, built-in exceptions, creating own exceptions, Stack Trace Elements. Input /Output Basics: Byte streams and Character streams, Reading and Writing, Console Reading and Writing Files.	8
IV	**Multithreading and Generic Programming:** Differences between multi-threading and multi-tasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic	8

	Programming: Generic classes, generic methods, Bounded Types: Restrictions and Limitations.	
V	**Event Driven Programming:** Graphics programming: Frame, Components, working with 2D shapes, Using colors, fonts, and images. Basics of event handling: event handlers, adapter classes, actions, mouse events, AWT event hierarchy. Introduction to Swing: layout management, Swing Components: Text Fields, Text Areas, Buttons, Check Boxes, Radio Buttons, Lists, choices, Scrollbars, Windows Menus and Dialog Boxes.	8

Text Books:

1. Patrick Naughton and Herbertz Schildt, "Java-2 The Complete Reference", Mc Graw Hill.
2. Ivor Horton, "Beginning Java-2", Wiley Publishing.
3. Bala guru swamy, "Programming with Java: A Primer", Tata McGraw Hill Education

Reference

1. Horetmann Cay and Cornell Gary, "Core Java Volume – I", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: **NIL**

Course Learning Outcomes:

CO1: Able to understand the use of OOPs concepts.
CO2: Able to solve real world problems using OOP techniques.
CO3: Able to understand the use of Packages, Interfaces, abstraction, Exceptions and threading concepts in Java
CO4: Able to understand the use of I/O and GUI programming in java.
CO5: Able to develop and understand database applications and Swing programming in Java

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA (AI &ML)**	**Year: I** **Semester: II**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Advanced Microsoft Excel with Tableau**
Course Code: MCA-128	**Title: Advanced Microsoft Excel with Tableau**

Course Objectives:
CO1: Understand the need and use of excel templates.
CO2: To provide knowledge of organizing and displaying large amounts of data.
CO3: Analyse data using pivot tables and pivot charts.
CO4: Learn the use of functions and formulas on Excel spreadsheet.
CO5: Learn to combine data sources using tableau.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**More Functions and Formulas: -** Formulas with multiple operators, Inserting and Editing a Function, Auto calculate and Manual Calculation, Defining Names, Using and Managing Defined Names, Displaying and Tracing Formulas, Understanding Formulas Errors, Using Logical Function(IF),Using Financial Functions (PMT), Using Database Functions (DSUM), Using Lookup Functions (VLOOKUP),User Defined and Compatibility Functions, Financial Functions, Date & Time Functions, Math & Trig Functions, Statistical Functions, Lookup & Reference Functions, Database Functions, Text Functions, text Functions, Logical Functions, Information Functions, Engineering and Cube Functions.	10
II	**Working with Data Ranges:-** Sorting by One Column, Sorting by Colors or Icons, Sorting by Multiple Columns, Sorting by a Custom List, Filtering Data, creating a Custom Auto Filter, Using an Advanced Filter. **Working with Pivot Tables:-** Creating a Pivot Table, Specifying Pivot Table data, changing a Pivot Table's Calculation, Filtering and Sorting a Pivot Table, Working with Pivot Table Layout, Grouping Pivot Table Items, updating a Pivot Table, formatting a Pivot Table, creating a Pivot Table, creating a Pivot Chart, Using Slicers, Sharing Slicers Between Pivot Tables.	10
III	**Analyzing and Organizing Data:-**	10

	Creating Scenarios, Creating a Scenario Report, Working with Data Tables, Using Goal Seek, Using Solver, Using Text to Columns, Grouping and Outlining Data, Using Subtotals, Consolidating Data by Position or Category, Consolidating Data Using Formulas. **Working with the Web and External Data: -** Inserting a Hyperlink, importing data from an Access database or Text File, Importing data from the Web and other Sources, Working with Existing Data Connections.	
IV	**Customizing Excel:-** Customizing the ribbon, Customizing the Quick Access tool bar, Using and Customizing Auto Correct, Changing Excel's Default Options, Creating a Custom AutoFill List, Creating a Custom Num is Format. **Working on Live Data and Dash boards: -** Creating dashboards on company specific data, working on live data, Dashboards with the help of Developer Ribbon, Working with critical & Complex formulas.	10
V	**Tableau: -** Understand how Tableau Desktop fits within the Tableau family of products, Combine data sources for use by Tableau, Connect to a variety of sources including flat files and databases, Understand data types and roles, Use key operations in Tableau-filtering, sorting, grouping and creating sets, Work with extracts (file formats used by Tableau), Build and format data visualizations, Work with maps and location-based data, Create interactive dashboards by using parameters, calculations and actions, Working with bins, groups and parameters, Working with folders, Creating story.	10

Text Book:

1. "Microsoft Excel 2019 Data Analysis and Business Modeling" by *Wayne Winston*

Reference Book:

1. "Microsoft Excel Data Analysis and Business Modelling "by *Wayne Winston*

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to use excel templates.
CO2: Able to organize large amount of data.
CO3: Able to analyze data using pivot tables and pivot charts.
CO4: Able to use functions and formulas on Excel spreadsheet
CO5: Able to combine data sources using tableau.

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA(AI &ML)**	**Year: I** **Semester: II**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: Data Base Management System Lab**
Course Code: MCA-127P	**Title: Data Base Management System Lab**

Course Objectives:
To learn the student should be made to:
CO1: Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
CO2: Be familiarized with a query language
CO3: Have hands on experience on DDL Commands
CO4: Have a good understanding of DML Commands and DCL commands
CO5: Familiarize advanced SQL queries and exposed to different applications

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L:0
T:0
P:4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Creation of a database and writing SQL queries to retrieve information from the database.	2
II	Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.	2
III	Perform the following: a. Viewing all databases, creating a Database, viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting b. Records in a Table, Saving (Commit) and Undoing (rollback).	2
IV	Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, backing up / restoring a Database.	2
V	For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer Join Sub queries-With IN clause, With EXISTS clause.	2
VI	For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views,	2

	Selecting from view.	
VII	Write a Pl/SQL program using FOR loop to insert ten rows into a database table.	2
VIII	Given the table EMPLOYEE (Emp No, Name, Salary, Designation, Dept ID) write a cursor to select the five highest paid employees from the table.	2

Reference / Text Books:

1. Fundamentals of Database System by Elmasari & Navathe, 7th Edition, 2018, Pearson Education.
2. Database System Concepts by Silberschatz, Korth & Sudarshan, 6th Edition, 2019, Mc Graw-Hill Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report	-
Seminar On Research Project Report	-
5) ESE	30
Total:	**50**

Course Learning Outcomes:

Student will be able to:

CO1: Design and implement a database schema for a given problem-domain

CO2: Populate and query a database

CO3: Create and maintain tables using PL/SQL.

Format-3

IIMT UNIVERSITY
Year: I / Semester: II

Programme: Degree **Class: MCA (AI &ML)**	**Year: I** **Semester: II**
Credits: 2 **Theory: 0** **Practical: 2**	**Subject: OOPS USING JAVA LAB**
Course Code: MCA-126P	**Title: OOPS USING JAVA LAB**

Course Objectives:
CO1: To write GUI programs using swing in java.
CO2: To write programs implementing OOPS concepts.
CO3: To write programs based on real world problems using java collection frame work.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 2 Credits

L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Write a program to enter a number from user and print the odd numbers between 1 to that number.	2
II	Write a Program to find perimeter of square if area is entered by user.	2
III	Write a program to handle Array index Out of Bounds exception.	2
IV	Write a Java program to copy an array by iterating the array.	2
V	Write a program to demonstrate a divide by zero program exception.	2
VI	Write a Java program to get the character at the given index within the String.	2
VII	Write a program to find the sum of each row of a matrix.	2
VIII	Write a program to find area of rectangle using parameterized constructor.	2

Reference / Text Books:
1. Patrick Naughton and Herbertz Schildt, “Java-2 The Complete Reference”, Mc. Graw Hill.
2. Balaguruswamy, “Programming with Java: A Primer”, Tata McGraw Hill Education.

Evaluation/Assessment Methodology

	Max. Marks:50
1) Class tasks/Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) ESE	30
Total:	**50**

Course Learning Outcomes: Student will be able to:
CO1: Write programs based on real world problems using java collection frame work.
CO2: Write GUI programs using swing in java.
CO3: Implement OOPS concepts.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA (AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Cryptography & Network Security**
Course Code: MCA-011	**Title: Cryptography & Network Security**

Course Objectives:

CO1: Understand various security attacks and their protection mechanism.
CO2 Apply and analyze various encryption algorithms.
CO3: Understand functions and algorithms to authenticate messages and study and apply different digital signature techniques.
CO4: Analyze different types of key distributions.
CO5: Study and appraise different IP and system security mechanism.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	Introduction to security attacks, Services and mechanism, Classical encryption techniques substitution ciphers and transposition ciphers, Cryptanalysis, Steganography, Stream and block ciphers. **Modern Block Ciphers:** Block ciphers principles, Shannon's theory of confusion and diffusion, Feistel structure, Data encryption standard (DES), Strength of DES, Idea of differential cryptanalysis, Block cipher modes of operations, Triple DES	08
II	Introduction to group, field, finite field of the form GF(p), Modular arithmetic, Prime and relative prime numbers, Extended Euclidean Algorithm, Advanced Encryption Standard (AES). Fermat's and Euler's theorem, Primality testing, Chinese Remainder theorem, Discrete Logarithmic Problem, Principals of public key crypto systems, RSA algorithm, Security of RSA	08
III	**Message Authentication Codes:** Authentication requirements, Authentication functions, Message authentication code, Hash functions, Birthday attacks, Security of hash functions, Secure hash algorithm (SHA). **Digital Signatures:** Digital Signatures, Elgamal Digital Signature Techniques, Digital signature standards (DSS), Proof of digital	08

	signature algorithm.	
IV	**Key Management and distribution:** Symmetric key distribution, Diffie- Hellman Key Exchange, Public key distribution, X.509 Certificates, Public key Infrastructure. **Authentication Applications:** Kerberos Electronic mail security: pretty good privacy (PGP), S/MIME.	08
V	**IP Security:** Architecture, Authentication header, Encapsulating security payloads, Combining security associations, Key management. Introduction to Secure Socket Layer, Secure electronic transaction (SET). **System Security:** Introductory idea of Intrusion, Intrusion detection, Viruses and related threats, firewalls.	08

Text Book:

1. Stallings W., "Cryptography and Network Security: Principals and Practice", Pearson Education.
2. Frouzan B. A., "Cryptography and Network Security", Mc Graw Hill.

Reference Book:

1. Kahate A., "Cryptography and Network Security", Tata Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Provide security of the data over the network.
CO2: Do research in the emerging areas of cryptography and network security.
CO3: Implement various networking protocols.
CO4: Protect any network from the threats in the world
CO5: Understand various protocols for network security to protect against the threats in the networks.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Data Warehousing & Data Mining**
Course Code: MCA-012	**Title: Data Warehousing & Data Mining**

Course Objectives:
CO1: Demonstrate knowledge of Data Warehouse and its components.
CO2: Discuss the process of Warehouse Planning and Implementation.
CO3: Discuss and implement various supervised and non-supervised learning algorithms on data.
CO4: Explain the various process of Data Mining and decide best according to type of data.
CO5: Explain process of knowledge discovery in database (KDD). Design Datan Mining model.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Data Warehousing**: Overview, Definition, Data Warehousing Components, building a Data Warehouse, Warehouse Database, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept.	08
II	**Data Warehouse Process and Technology:** Warehousing Strategy, Warehouse /management and Support Processes, Warehouse Planning and Implementation, Hardware and Operating Systems for Data Warehousing, Client/Server Computing Model & Data Warehousing. Parallel Processors & Cluster Systems, Distributed DBMS implementations, Warehousing Software, Warehouse Schema Design	08
III	**Data Mining**: Overview, Motivation, Definition & Functionalities, Data Processing, Form of Data Pre-processing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer and Human inspection), Inconsistent Data, Data Integration and Transformation. Data Reduction:-Data Cube Aggregation, Dimensionality reduction, Data Compression, Numerosity Reduction, Discretization and Concept hierarchy generation, Decision Tree	08
IV	**Classification:** Definition, Data Generalization, Analytical	08

	Characterization, Analysis of attribute relevance, Mining Class comparisons, Statistical measures in large Databases, Statistical-Based Algorithms, Distance-Based Algorithms, Decision Tree-Based Algorithms. **Clustering**: Introduction, Similarity and Distance Measures, Hierarchical and Partitional Algorithms. Hierarchical Clustering- CURE and Chameleon. Density Based Methods DBSCAN, OPTICS. Grid Based Methods- STING, CLIQUE. Model Based Method – Statistical Approach, Association rules: Introduction, Large Item sets, Basic Algorithms, Parallel and Distributed Algorithms, Neural Network approach.	
V	**Data Visualization and Overall Perspective**: Aggregation, Historical information, Query Facility, OLAP function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mininginter face, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse. Warehousing applications and Recent Trends: Types of Warehousing Applications, Web Mining, Spatial Mining and Temporal Mining	08

Text Book:

1. Alex Berson, Stephen J. Smith "Data Warehousing, Data-Mining & OLAP", TMH.
2. Mark Humphries, Michael W. Hawkins, Michelle C. Dy, "Data Warehousing: Architecture and Implementation", Pearson.
3. I.Singh, "Data Mining and Warehousing", Khanna Publishing House.

Reference Book:

1. Margaret H. Dunham, S. Sridhar," Data Mining: Introductory and Advanced Topics" Pearson Education 5. Arun K. Pujari, "Data Mining Techniques" Universities Press.
2. Pieter Adriaans, Dolf Zantinge, "Data-Mining", Pearson Education

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand warehousing architectures and tools for systematically organizing large data base and use their data to make strategic decisions.
CO2: Understand KDD process for finding interesting pattern from warehouse.
CO3: Remove redundancy and incomplete data from the dataset using data preprocessing methods.
CO4: Characterize the kinds of patterns that can be discovered by association rule mining.
CO5: Develop a data mining application for data analysis using various tools.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Software Project Management**
Course Code: MCA-013	**Title: Software Project Management**

Course Objectives:

CO1: Identify project planning objectives, along with various cost/effort estimation models.
CO2 Organize & schedule project activities to compute critical path for risk analysis
CO3: Monitor and control project activities.
CO4: Formulate testing objectives and test plan to ensure good software quality under SEI-CMM
CO5: Configure changes and manage risks using project management tools.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Project Evaluation and Project Planning:** Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation–Strategic program Management – Stepwise Project Planning.	08
II	**Project Life Cycle and Effort Estimation:** Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques–COSMIC Full function points–COCOMOII–a Parametric Productivity Model.	08
III	**Activity Planning and Risk Management:** Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation– Creation of Critical paths – Cost schedules.	08
IV	**Project Management and Control:** Framework for Management and control – Collection of data–Visualizing progress–Cost monitoring–	08

	arned Value Analysis –Prioritizing Monitoring– Project tracking– Change control Software Configuration Management – Managing contracts – Contract Management.	
V	**Staffing in Software Projects:** Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtualteams– Communicationsgenres–Communicationplans–Leadership.	08

Text Book:

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management" – 5th Edition, Mc Graw Hill, New Delhi, 2012.
2. Robert K. Wysocki — "Effective Software Project Management" – Wiley Publication, 2011.
3. Walker Royce: — "Software Project Management" - Addison-Wesley, 1998.
4. Gopalaswamy Ramesh, — "Managing Global Software Projects" – Mc Graw Hill Education (India), Fourteenth Reprint 2013.

Reference Book:

1. Koontz Harold & Weihrich Heinz, "Essentials of Management", Mc Graw Hill 5th Edition 2008.
2. Robbins and Coulter, "Management", Prentice Hall of India, 9th edition.
3. James A. F., Stoner, "Management", Pearson Education Delhi.
4. P. D. Chaturvedi, "Business Communication", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Identify the different project contexts and suggest an appropriate management strategy.
CO2: Practice the role of professional ethics in successful software development.
CO3: Identify and describe the key phases of project management.
CO4: Determine an appropriate project management approach.
CO5: Evaluation of the business context and scope of the project.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Cloud Computing**
Course Code: MCA-014	**Title: Cloud Computing**

Course Objectives:

CO1: Understand the concepts of Cloud Computing, key technologies, strengths and limitations of cloud computing.
CO2 Develop the ability to understand and use the architecture to compute and storage cloud, service and models.
CO3: Understand the application in cloud computing.
CO4: Learn the key and enabling technologies that help in the development of cloud.
CO5: Explain the core issues of cloud computing such as resource management and security.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed, History of Cloud Computing - Cloud Architecture - Types of Clouds - Business models around Clouds – Major Players in Cloud Computing-issues in Clouds - Eucalyptus - Nimbus - Open Nebula, Cloud Sim.	08
II	**Cloud Services:** Types of Cloud services: Software as a Service- Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers- Google, Amazon, Microsoft Azure, IBM, Sales force.	08
III	**Collaborating Using Cloud Services:** Email Communication over the Cloud - CRM Management – Project Management-Event Management - Task Management – Calendar - Schedules - Word Processing – Presentation – Spreadsheet - Databases – Desktop - Social Networks and Groupware.	08
IV	**Virtualization for Cloud:** Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - supervisors – Xen, KVM, VMware, Virtual Box, Hyper-V.	08
V	**Security, Standards and Applications:** Security in Clouds: Cloud security	08

	challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging – Standards for Security, End user access to cloud computing, Mobile Internet devices and the cloud. Hadoop – Map Reduce – Virtual Box — Google App Engine – Programming Environment for Google App Engine	

Text Book:

1. David E.Y. Sarna, "Implementing and Developing Cloud Application", CRC press 2011.
2. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, Draft cloud computing synopsis and recommendation, May2011.
3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata Mc Graw-Hill2010.

Reference Book:

1. Haley Beard, "Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July2008.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand the fundamental principles of distributed computing.
CO2: Understand how the distributed computing environments known as Grids can be built from lower-level services.
CO3: Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
CO4: Analyze the performance of Cloud Computing.
CO5: Understand the concept of Cloud Security.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Compiler Design**
Course Code: MCA-015	**Title: Compiler Design**

Course Objectives:

CO1: Acquire knowledge of different phases and passes of the compiler and also able to use the compiler tools like LEX, YACC, etc. Students will also be able to design different types of compiler tools to meet the requirements of the realistic constraints of compilers.
CO2: Understand the parser and its types i.e. Top-Down and Bottom-up parsers and construction of LL, SLR, CLR, and LALR parsing table.
CO3: Implement the compiler using syntax-directed translation method and get knowledge about the synthesized and inherited attributes.
CO4: Acquire knowledge about run time data structure like symbol table organization and different techniques used in that.
CO5: Understand the target machine's run time environment, its instruction set for code generation and techniques used for code optimization.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Compiler**: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, Optimization of DFA-Based Pattern Matchers implementation of lexical analyzers, lexical-analyzer generator, LEX compiler, Formal grammars and their application to syntax analysis, BNF notation, ambiguity, YACC. The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.	08
II	**Basic Parsing Techniques:** Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, implementation of LR parsing tables.	08
III	**Syntax-directed Translation:** Syntax-directed Translation schemes,	08

	Implementation of Syntax-directed Translators, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top-down parser. More about translation: Array references in arithmetic expressions, procedures call, declarations and case statements.	
IV	**Symbol Tables**: Data structure for symbols tables, representing scope information. Run- Time Administration: Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.	08
V	**Code Generation:** Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws, Global Data-Flow analysis.	08

Text Book:

1. K. Muneeswaran, Compiler Design, First Edition, Oxford University Press.
2. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata Mc Graw-Hill, 2003.
3. Henk Alblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI,2001.

Reference Book:

1. Aho, Sethi & Ullman, "Compilers: Principles, Techniques and Tools", Pearson Education
2. V Raghvan, "Principles of Compiler Design", TMH
3. Kenneth Louden," Compiler Construction", Cengage Learning.
4. Charles Fischer and Ricard Le Blanc," Crafting a Compiler

Evaluation/Assessment Methodology

	Max. Marks 100
1) Classtasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Explain the concepts and different phases of compilation with compile time error handling.
CO2: Represent language tokens using regular expressions, context free grammar and finite automata and design lexical analyzer for a language.
CO3: Compare top down with bottom-up parsers, and develop appropriate parser to produce parse tree representation of the input.
CO4: Generate intermediate code for statements in high level language.
CO5: Design syntax directed translation schemes for a given context free grammar. Generation and techniques used for code optimization.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Web Technology**
Course Code: MCA-021	**Title: Web Technology**

Course Objectives:

CO1: Apply the knowledge of HTML and CSS to develop web application and analyze the insights of internet programming to implement complete application over the web.
CO2: Understand, analyze and apply the role of JavaScript in the workings of the web and web applications.
CO3: Understand, analyze and build dynamic web applications using servlet and JSP.
CO4: Develop Spring-based Java applications using Java configuration, XML configuration, annotation-based configuration, beans and their scopes, and properties.
CO5: Develop web application using Spring Boot and RESTFul Web Services

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Web Page Designing:** Introduction and Web Development Strategies, History of Web and Internet, Protocols Governing Web, HTML-Introduction, HTML Tags, HTML-Grouping Using Div & Span, HTML-Lists, HTML-Images, HTML- Hyperlink, HTML-Table, HTML-I frame, HTML-Form, Introduction of CSS, CSS Syntax, External Style Sheet using < link >, Multiple Style Sheets, Value Lengths and Percentages, CSS-Selectors, CSS-Box Model, Floats, Clear, Introduction to Bootstrap.	08
II	**Scripting:** Introduction to JavaScript, Creating Variables in Java Script, Creating Functions in Java Script, UI Events, Returning Data from Functions, Working with Conditions, looping in Java Script, Block Scope Variables, Working with Objects, Creating Object using Object Literals, Manipulating DOM Elements with JavaScript	08
III	**Web Application development using JSP & Servlets:** Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with Http Session. Java Server Pages (JSP): Introduction, Java Server Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions,	08

	Directives, Custom Tag Libraries.	
IV	**Spring:** Spring Core Basics-Spring Dependency Injection concepts, Introduction to Design patterns, Factory Design Pattern, Strategy Design pattern, Spring Inversion of Control, AOP, Bean Scopes- Singleton, Prototype, Request, Session, Application, Web Socket, Auto wiring, Annotations, Life Cycle Call backs, Bean Configuration styles	08
V	**Spring Boot:** Spring Boot-Spring Boot Configuration, Spring Boot Annotations, Spring Boot Actuator, Spring Boot Build Systems, Spring Boot Code Structure, Spring Boot Runners, Logger, BUILDING RESTFUL WEB SERVICES, Rest Controller, Request Mapping, Request Body, Path Variable, Request Parameter, GET, POST, PUT, DELETE APIs, Build Web Applications	08

Text Book:

1. Burdman, Jessica, "Collaborative Web Development" Addison Wesley
2. Xavier, C, "Web Technology and Design" , New Age International
3. Ivan Bayross," HTML, DHTML, Java Script, Perl & CGI", BPB Publication

Reference Book:

1. Bhave, "Programming with Java", Pearson Education
2. Hans Bergsten, "Java Server Pages", SPD O'Reilly
3. Naughton, Schildt, "The Complete Reference JAVA 2", TMH

Evaluation/Assessment Methodology

	Max. Marks 100
1) Classtasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Students are able to develop a dynamic webpage by the use of java script and DHTML.
CO2: Students will be able to write a well-formed / valid XML document.
CO3: Students will be able to connect a java program to a DBMS and perform insert, update and delete operations on DBMS table.
CO4: Students will be able to write a server side java application called Servlet to catch form data sent from client, process it and store it on database.
CO5: Students will be able to write a server-side java application called JSP to catch form data sent from client and store it on database.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Big Data**
Course Code: MCA-022	**Title: Big Data**

Course Objectives:
CO1: Demonstrate knowledge of Big Data Analytics concepts and its applications in business.
CO2: Demonstrate functions and components of Map Reduce Framework and HDFS.
CO3: Develop queries in No SQL environment.
CO4: Explain process of developing Map Reduce based distributed processing applications.
CO5: Explain process of developing applications using HBASE, Hive, Pig etc.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Big Data**: Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features – security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	**08**
II	**Hadoop:** History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, Hadoop Echo System. **Map-Reduce:** Map-Reduce framework and basics, how Map Reduce works, developing a Map Reduce application, unit tests with MR unit, test data and local tests, anatomy of a Map Reduce job run, failures, job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats, Map Reduce features, Real-world Map Reduce	**08**
III	**HDFS (Hadoop Distributed File System):** Design of HDFS, HDFS concepts, benefits and challenges, file sizes, block sizes and block abstraction in HDFS, data replication, how does HDFS store, read, and write files, Java interfaces to HDFS, command line interface, Hadoop file system interfaces, data flow, data ingest with Flume and Scoop, Hadoop archives, Hadoop I/O:	**08**

	Compression, serialization, Avro and file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop configuration, security inHadoop, administering Hadoop, HDFS monitoring & maintenance, Hadoop benchmarks, Hadoop in the cloud	
IV	**Hadoop Eco System and YARN:** Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features – Name Node high availability, HDFS federation, MRv2, YARN, Running MRv1 in YARN. **No SQL** Databases: Introduction to No SQL Mongo DB: Introduction, data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections **Spark**: Installing spark, spark applications, jobs, stages and tasks, Resilient Distributed Databases, anatomy of a Spark job run, Spark on YARN **SCALA:** Introduction, classes and objects, basic types and operators, built-in control structures, functions and closures, inheritance.	**08**
V	**Hadoop Eco System Frame works**: Applications on Big Data using Pig, Hive and H Base **Pig:** Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, **Hive** - Apache Hive architecture and installation, Hive shell, Hive services, Hive met a store, comparison with traditional databases, Hive QL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & sub queries. **H Base**– H base concepts, clients, example, H base vs RDBMS, advanced usage, schema design, advance indexing, Zookeeper – how it helps in monitoring a cluster, how to build applications with Zookeeper. IBM Big Data strategy, introduction to Info sphere, Big Insights and Big Sheets, introduction to Big SQL.	**08**

Text Book:

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.
2. Big-Data Black Book, DT Editorial Services, Wiley.
3. Dirk de Roos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", Mc Graw Hill.

Reference Book:

1. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers and Techniques", Prentice Hall.
2. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley &Sons
3. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A Hands On Approach ",VPT

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10

5) ESE	75
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Identify Big Data and its Business Implications. CO2: List the components of Hadoop and Hadoop Eco-System CO3: Access and Process Data on Distributed File System CO4: Manage Job Execution in Hadoop Environment CO5: Develop Big Data Solutions using Hadoop Eco System	

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Simulation and Modelling**
Course Code: MCA-023	**Title: Simulation and Modelling**

Course Objectives:
CO1: Study the concept of system, its components and types.
CO2: Understand and analyze nature and techniques of major simulation models.
CO3: Study and simulation. Analyze the idea of continuous and discrete system
CO4: Understand the notion of system dynamics and system dynamics diagrams.
CO5: Finding critical path computation and understanding PERT networks

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	System definition and components, stochastic activities, continuous and discrete systems, System modeling, Types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study.	**08**
II	System simulation, Need of simulation, Basic nature of simulation, techniques of simulation, comparison of simulation and analytical methods, types of system Simulation, real time simulation, hybrid simulation, simulation of pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag model, Cobweb model.	**08**
III	Simulation of continuous Systems, analog vs digital simulation, simulation of water reservoir system, simulation of a servo system, simulation of an auto-pilot. Discrete system simulation, fixed time step vs. event-to-event model, generation of random numbers, test of randomness, Monte-Carlo computation vs. stochastic simulation.	**08**
IV	System dynamics, exponential growth models, exponential decay models, logistic curves, system dynamics diagrams, world model.	**08**
V	Simulation of PERT networks, critical path computation, uncertainties in activity duration, resource allocation and consideration, Simulation languages, object-oriented simulation	**08**

Text Book:

1. Geoffrey Gordon, "System Simulation", PHI 2. Narsingh Deo, "System Simulation with digital computer", PHI.
Reference Book: 1. Averill M. Law and W. David Kelton, "Simulation Modelling and Analysis", TMH.

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe the role of important elements of discrete event simulation and modeling paradigm.
CO2: Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
CO3: Interpret the model and apply the results to resolve critical issues in a real world environment.
CO4: Apply random number variates to develop simulation models
CO5: Analyze output data produced by a model and test validity of the model

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Software Testing & Quality Assurance**
Course Code: MCA-024	**Title: Software Testing & Quality Assurance**

Course Objectives:
CO1: Test the software by applying testing techniques to deliver a product free from bugs.
CO2: Investigate the scenario and select the proper testing technique.
CO3: Explore the test automation concepts and tools and estimation of cost, schedule based on standard metrics.
CO4: Understand how to detect, classify, prevent and remove defects.
CO5: Choose appropriate quality assurance models and develop quality. Ability to conduct formal inspections, record and evaluate results of inspections.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Software Testing Basics:** Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.	08
II	**Testing Techniques and Levels of Testing:** Using White Box Approach to Test design– Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing-Usability and Accessibility Testing, Configuration Testing, Compatibility Testing.	08
III	**Software Test Automation And Quality Metrics:** Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality	08

	Function Deployment, Taguchi Quality Loss Function, Cost of Quality.	
IV	**Fundamentals of Software Quality Assurance:** SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.	08
V	**Software Assurance Models:** Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P- CMM. **Software Quality Assurance Trends:** Software Process- PSP and TSP, OO Methodology, Clean room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their effect on Software Quality.	08

Text Book:

1. Aditya P. Mathur, "Foundations of Software Testing", Pearson.
2. Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press.
3. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Auerbach Publications.
4. William Perry, "Effective Methods of Software Testing", Wiley Publishing, Third Edition.

Reference Book:

1. Renu Rajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata Mc Graw Hill.
2. Stephen Kan, "Metrics and Models in Software Quality", Addison – Wesley, Second Edition.
3. S. A. Kelkar, "Software quality and Testing", PHI Learning Pvt, Ltd.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Students learn to apply software testing knowledge and engineering methods

CO2: Students understand and identify various software testing problems, and solve these problems by designing and selecting software test models, criteria, strategies, and methods

CO3: Students analyze and understand the use of software testing methods and modern software testing tools for their testing projects

CO4: Students identify defects and manage those defects for improvement in quality for given Software Choose appropriate quality assurance models and develop quality.

CO5: Ability to conduct formal inspections, record and evaluate results of inspections.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Digital Image Processing**
Course Code: MCA-025	**Title: Digital Image Processing**

Course Objectives:

CO1: Explain the basic concepts of two-dimensional signal acquisition, sampling, quantization and color model.
CO2: Apply image processing techniques for image enhancement in both the spatial and frequency domains.
CO3: Apply and compare image restoration techniques in both spatial and frequency domain.
CO4: Compare edge based and region-based segmentation algorithms for ROI extraction.
CO5: Explain compression techniques and descriptors for image processing.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Digital Image Fundamentals:** Steps in Digital Image Processing–Components–Elements of Visual Perception–Image Sensing and Acquisition–Image Sampling and Quantization–Relationships between pixels–Color image fundamentals – RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms – DFT, DCT.	08
II	**Image Enhancement:** Spatial Domain: Gray level transformations–Histogram processing – Basics of Spatial Filtering–Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.	08
III	**Image Restoration:** Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics –Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	08
IV	**Image Segmentation:** Edge detection, Edge linking via Hough transform – Thresholding – Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation,	08

	Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.	
V	**Image Compression and Recognition:** Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture – Patterns and Pattern classes – Recognition based on matching.	08

Text Book:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, Third Edition, 2010.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.
3. Kenneth R. Castleman, "Digital Image Processing" Pears on, 2006.

Reference Book:

1. D, E. Dudgeon and R M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
2. William K. Pratt, "Digital Image Processing" John Wiley, New York, 2002.
3. Milan Sonka et al, "Image processing, analysis and machine vision Brookes/Cole", Vikas Publishing House, 2nd edition,1999.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/SessionalExamination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Review the fundamental concepts of a digital image processing system.
CO2: Analyze images in the frequency domain using various transforms.
CO3: Evaluate the techniques for image enhancement and image restoration.
CO4: Categorize various compression techniques.
CO5: Interpret Image compression standards.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Computer Networks**
Course Code: MCA-233	**Title: Computer Networks**

Course Objectives:

CO1: Describe communication models TCP/IP, ISO-OSI model, network topologies along with communicating devices and connecting media.
CO2: Apply knowledge of error detection, correction and learn concepts of flow control along with error control.
CO3: Classify various IP addressing techniques, sub netting along with network routing protocols and algorithms.
CO4: Understand various transport layer protocols and their design considerations along with congestion control to maintain Quality of Service.
CO5: Understand applications-layer protocols and elementary standards of cryptography and network security.

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Data Communications**: Introduction: Data communication Components and characteristics, Data representation and Data flow. **Networks:** LAN, WAN, MAN, Topologies. **Protocols and Standards**: ISO-OSI model and TCP-IP Model. **Network Connecting Devices:** HUB, Bridge, Switch, Router and Gateways. **Transmission Media:** Guided and unguided Media **Classification and Arrangement:** Wired LANs and Wireless LANs	08
II	**Data Link Layer:** **Error Detection and Error Correction:** Types of errors, LRC, VRC, Checksum, CRC, and Hamming Code. **Flow Control and Error Control:** Stop and Wait Protocol, Sliding Window, Go-back-N-ARQ Protocol and Selective-Repeat ARQ Protocol. **Channel Allocation Protocols:** Random Access, Controlled and Channelization techniques such as ALOHA, CSMA, CSMA/CD, CDMA/CA, TDMA, FDMA, Token Passing, etc.	08
III	**Network Layer:**	08

	Switching Techniques: Circuit Switching, Packet Switching, and Message Switching. **Logical addressing:** IPv4 and IPv6 Address schemes, Classes and sub netting **Network Layer Protocols:** ARP, RARP, BOOTP and DHCP **Routing Techniques:** Inter domain and Intra domain routing with examples.	
IV	**Transport Layer:** **Introduction to Transport Layer**: Process-to-Process Delivery: Reliable and unreliable Connection, Port and Socket Addressing **Transport Layer Protocols with packet formats:** User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP). **Congestion Control:** Techniques for handling the Congestion Control. **Quality of Service (QoS):** Flow Characteristics and techniques to improve QoS.	08
V	**Application Layer:** **Basic Concept of Application Layer:** Domain Name System, World Wide Web, Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login. **Introduction to Cryptography:** Definition, Goal, Applications, Attacks, Encryption, decryption, public-key and private key cryptography.	08

Text Book:

1. Behrouz Forouzan, "Data Communication and Networking", Mc Graw Hill
2. Andrew Tanenbaum "Computer Networks", Prentice Hall.
3. William Stallings, "Data and Computer Communication", Pearson.

Reference Book:

1. Kurose and Ross, "Computer Networking- A Top-Down Approach", Pearson.
2. Peterson and Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann
3. W. A. Shay, "Understanding Communications and Networks", Cengage Learning.
4. D. Comer, "Computer Networks and Internets", Pearson.
5. Behrouz Forouzan, "TCP/IP Protocol Suite", McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand Basics of Computer Networks and different Transmission Media.
CO2: Differentiate Protocols which play a major role in providing internet effectively.
CO3: Understand various protocol layers and inner operations.
CO4: Understand architectures of network protocols.
CO5: Understand security issues in network protocols.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Machine Learning**
Course Code: MCA-234	**Title: Machine Learning**

Course Objectives:
CO1: To understand the need for machine learning for various problem solving
CO2: To understand a wide variety of learning algorithms and how to evaluate models generated from data
CO3: To understand the latest trends in machine learning
CO4: To design appropriate machine learning algorithms and apply the algorithms to a real-world problem
CO5: To optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Python for Machine Learning:** Why python? Python Syntax, Data types in python – integers, floats, complex, strings, bools, Type casting and I/O operations, Introduction to lists, Flow control statements - if, elif, else, for, while, break, continue, pass, Data Structures – list, set, tuples, dictionaries., Loops with iterables, Functions – with/without arguments, with/without return, Reading and writing files – text and pickle. **Numerical Python for Machine Learning:** Introduction to 1-dimensonal arrays – data types, shape, size., Indexing and slicing in 1-dimensonal arrays. Operation on 1-dimensonal arrays – sum, mean, min, max, argmax, argmin, 2-dimensonal arrays., 2-dimensonal arrays – indexing, slicing, boolean indexing, custom indexing., Reshaping arrays., Operation on 2-dimensonal arrays (row wise, column wise and overall) – sum, mean, min, max, argmax, argmin., Mathematical operations and universal Functions (ufunc), Special arrays – ones, zeros, empty, diagonal. Saving and reading numpy arrays.	08
II	**Data handling and Visualization:** Introduction to pandas. Pandas series from	08

	list, numpy. nd array, Operation on numpy series., Pandas data frame–multidimensional list, numpy. nd array, dictionary. Data and time series., Data frame indexing – loc, iloc, at, iat., Data frame – info, describe, mean, median, mode, apply,. Mat plot lib and sea born – linear plot and scatter plot., Histogram, bar and count plots., Sea born scatter and joint plot., Strip plot, box and whisker plot, violin plot., Plots with pandas – line and scatter plots, Imputation of missing values manually with pandas. **Exploratory Data Analysis (EDA):** What is EDA? And why? Population and Sample (sampling), Central Limit Theorem., One sample test – t-test, z-test., Two sample test – z-test, t-test (paired and independent),Multiple sample test – Analysis of Variance (ANOVA), Goodness of Fitness.	
III	**Introduction to Machine Learning:** What is machine learning? Evaluation and Application., Types – supervised, unsupervised, semi- supervised, and reinforcement, Supervised – regression and classification, Unsupervised – Clustering and Outlier detection, Use of machine learning in Google, Facebook, Amazon, LinkedIn, Machine learning in Agriculture and Healthcare Industry, Weather forecasting with Machine Learning.	08
IV	**Supervised Machine Learning:** Linear Regression – Sample data, Split dataset – Train and Test, Under fitting and Over fitting, Linear Regression on scikit-learn toy dataset, Feature selection (for regression) with correlation, f-regression score, mutual info regression score, Logistic Regression on iris dataset (and pair plot), Feature selection (for classification) with correlation, chi2 score, f class if score, mutual info class if score, K-Nearest Neigh bor (KNN) on Bank Marketing Dataset, Decision trees – telecom churn dataset, Naive bayes classifier and Support Vector Machine (SVM), Ensemble Methods – Gradient Boosting and Ada Boost. Cross-validation and Grid Search CV, Saving ML model with pickle, Data imputation with machine learning algorithm. **Unsupervised Machine Learning:** Clustering with K-Means, Elbow Method, Silhouette score, K-Means vs K-Mini Batch, K-Means vs C-Means., Hierarchical Clustering., Outlier detection – Local Outlier Factor (LOF). Density-Based Spatial Clustering of Applications with Noise (DBSCAN), Introduction to Market Basket Analysis. .	08
V	**Time Series Analysis (TSA):** Introduction to TSA, Auto regression (AR). Moving Average (MA), Autoregressive Moving Average (ARMA),. Autoregressive Integrated Moving Average (ARIMA).	08

Text Book:

1. Tom M. Mitchell, —Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press 2004.
3. Stephen Marsland, —Machine learning: An Algorithmic Perspective, CRC Press, 2009.

Reference Book:

1. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer- Verlag.5.
2. M. Gopal, "Applied Machine Learning", McGraw Hill Education

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	15
2) Presentations /Seminar	-

3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Recognize the characteristics of machine learning strategies. CO2: Apply various supervised learning methods to appropriate problems. CO3: Identify and integrate more than one technique to enhance the performance of learning. CO4: Create probabilistic and unsupervised learning models for handling unknown pattern. CO5: Analyze the co-occurrence of data to find interesting frequent patterns.	

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 4 **Theory: 4** **Practical: 0**	**Subject: Advance Machine Learning**
Course Code: MCA-235	**Title: Advance Machine Learning**

Course Objectives:
CO1: To understand the basic theory underlying machine learning
CO2: To understand the concept of Artificial intelligence and Natural Language Processing
CO3: To understand a range of machine learning algorithms along with their strengths and weaknesses.
CO4: Apply machine learning algorithms to solve problems of moderate complexity
CO5: To understand the use of Neural Network in Machine learning.

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Artificial Intelligence (theoretical):** Defining Artificial Intelligence, history of AI, machine learning vs artificial intelligence, cloud and AI, industrial use cases and real-world applications, areas where AI lacks, the future of AI - benefits and disadvantages.	08
II	**Introduction to Natural Language Processing:** What is NLP, corpus, text cleaning and pre-processing in python (re and string modules), bags of words, tokenization – count and TF-IDF (Term Frequency - Inverse Document Frequency) to kenizer, stop words and filtering of stop words, introduction to 20 newsgroups dataset, classification (text) on 20 newsgroups dataset.	08
III	**Advance Natural Language Processing:** Natural Language Toolkit (NLTK), accessing text corpora, lexical resources in NLTK, word and sentence tokenization, frequency distribution word frequency distribution (Freq Dist), word stemming and Porter Stemmer, lexical database – word net, synsets, lemma and lemmatization, word net lemmatizer, sentiment analysis (on twitter dataset) and subjectivity, analysing text and word similarity, analysing meaning of words and sentences	08
IV	**Introduction to Neural Networks (NN):** Perceptron and neural network, multi-layer perceptron classifier and regress or, artificial neural network (ANN), deep neural network (DNN), python modules	08

	for deep neural network – Tensor Flow, Keras, Py Torch and Theano, deep neural network layers – dense and flatten, image classification using deep neural network.	
V	**Convolution Neural Networks (CNN):** Understanding convolution, more deep neural network layers – convolution, pooling, dropout and batch normalization, activations – relu, soft max and sigmoid and activation layer, image classification using convolution neural network (CNN), over fitting and under fitting in CNN, pre-processing layers, types of models (in Tensor Flow) – sequential and functional, transfer learning and model deployment.	08

Text Book:

1. Tom M. Mitchell, —Machine Learning, Mc Graw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, —Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press 2004.

Reference Book:

1. Stephen Mars land, —Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	15
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Recognize the characteristics of machine learning strategies.
CO2: Apply various supervised learning methods to appropriate problems.
CO3: Identify and integrate more than one technique to enhance the performance of learning.
CO4: Create probabilistic and unsupervised learning models for handling unknown pattern.
CO5: Analyze the co-occurrence of data to find interesting frequent patterns.

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 2 **Theory: 2** **Practical: 0**	**Subject: Machine Learning Lab**
Course Code: MCA-334P	**Title: Machine Learning Lab**

Course Objectives:

CO1: To understand the basic theory underlying machine learning.
CO2: To be able to formulate machine learning problems corresponding to different applications.
CO3: To understand a range of machine learning algorithms a long with their strengths and weaknesses.
CO4: To be able to apply machine learning algorithms to solve problems of moderate complexity.
CO5: To apply the algorithms to a real-world problem, optimize the models learned and report on the expect that can be achieved by applying the models.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits

L:0
T:0
P:4(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	1. Implement Decision Tree learning	02
	2. Implement Logistic Regression	02
	3. Implement classification using Multilayer perceptron	02
	4. Implement classification using SVM	02
	5. Implement Ada boost	02
	6. Implement Bagging using Random Forests	02
	7. Implement k-nearest Neighbors algorithm	02
	8. Implement K-means, K-Modes Clustering to Find Natural Patterns in Data	02
	9. Implement Hierarchical clustering	02
	10. Implement Gaussian Mixture Model Using the Expectation Maximization	02

Text Book:

1. Marco Gori, Machine Learning: A Constraint-Based Approach, Morgan Kaufmann. 2017.
2. Ethem Alpaydin, Machine Learning: The New AI, MIT Press-2016.

Reference Book:

Book:

1. Ryszard, S., Michalski, J. G. Carbonell and Tom M. Mitchell, Machine Learning: An Artificial Intelligence Approach, Volume 1, Elsevier. 2014
2. Stephen Marsland, Taylor & Francis 2009. Machine Learning: An Algorithmic Perspective.

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	25 - - - 25
Total:	**50**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Appreciate the importance of visualization in the data analytics solution CO2: Apply structured thinking to unstructured problems. CO3: Understand a very broad collection of machine learning algorithms and problems CO4: Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory CO5: Develop an appreciation for what is involved in learning from data.	

Format-3

IIMT UNIVERSITY
Year: II / Semester: III

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: III**
Credits: 2 **Theory: 2** **Practical: 0**	**Subject: Advance Machine Learning Lab**
Course Code: MCA-335P	**Title: Advance Machine Learning Lab**

Course Objectives:
CO1: Apply Feature Extracting and Feature Engineering techniques.
CO2: Implement Exploratory Data Analysis on real time datasets.
CO3: Apply ensemble learners to evaluate model diagnosis.
CO4: Illustrate Association Rule Mining.
CO5: Predict clusters from real time data using various Clustering Algorithms.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks / 1 Credits

L:0
T:0
P:4(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	1. Extract data from different file formats and display the summary statistics.	02
	2. Write a program that extracts the words (features) used in a sentence.	02
	3. Write a program for edge detection to extract edge-based features from a sample image.	02
	4. Write a program to extract SURF/SIFT feature descriptors from a sample image.	02
	5. Write a program to evaluate and compare learning curves of leave-one-out with two-, three-, five-, and ten-fold cross-validation on a learning problem using real time dataset.	02
	6. Create a Bayesian Graphical Model for earthquake problem (using python package pgmpy)	02
	7. Write a to evaluate classifiers using baseline methods constant, uniform, stratified, prior and most frequent on wine dataset and find the accuracy. Identify the patterns using RoC, AUC	02
	8. Write a program to generate Association Rules using the Apriori algorithm.	02
	9. Write a program to generate Association Rules using the FP-Growth algorithm.	02
	10. Write a program to implement K-means clustering algorithm.	02

Text Book:

1. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems, Apress. 2018.

<table>
<tr><td colspan="2">2. Sikar Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Ninth impression,.</td></tr>
<tr><td colspan="2">Reference Book:
Book:
1. Manohar Swamynathan, Mastering Machine Learning with Python in Six Steps –A Practical Implementation Guide to Predictive Data Analytics Using Python, Apress,2017.</td></tr>
<tr><td colspan="2">Evaluation/Assessment Methodology</td></tr>
<tr><td></td><td>Max. Marks 100</td></tr>
<tr><td>1) Class tasks/Sessional Examination tasks
2) Presentations /Seminar
3) Assignments
4) Research Project Report
Seminar On Research Project Report
5) ESE</td><td>25
-
-
-

25</td></tr>
<tr><td>Total:</td><td>50</td></tr>
<tr><td colspan="2">Prerequisites for the course: NIL</td></tr>
<tr><td colspan="2">Course Learning Outcomes:
CO1: Appreciate the importance of visualization in the data analytics solution
CO2: Apply structured thinking to unstructured problems
CO3: Understand a very broad collection of machine learning algorithms and problems
CO4: Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory
CO5: Develop an appreciation for what is involved in learning from data.</td></tr>
</table>

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Privacy and Security in Online Social Media**
Course Code: MCA-031	**Title: Privacy and Security in Online Social Media**

Course Objectives:
CO1: Understand working of online social networks
CO2: Describe privacy policies of online social media
CO3: Analyse countermeasures to control information sharing in Online social networks.
CO4: Apply knowledge of identity management in Online social networks
CO5: Compare various privacy issues associated with popular social media.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Online Social Networks:** Introduction to Social Networks, From offline to Online Communities, Online Social Networks, Evolution of Online Social Networks, Analysis and Properties, Security Issues in Online Social Networks, Trust Management in Online Social Networks, Controlled Information Sharing in Online Social Networks, Identity Management in Online Social Networks, data collection from social networks, challenges, opportunities, and pitfalls in online social networks, APIs; Collecting data from Online social media.	08
II	**Trust Management in Online Social Networks:** Trust and Policies, Trust and Reputation Systems, Trust in Online Social, Trust Properties, Trust Components, Social Trust and Social Capital, Trust Evaluation Models, Trust, credibility, and reputations in social systems; Online social media and Policing, Information privacy disclosure, revelation, and its effects in OSM and online social networks; Phishing in OSM & Identifying fraudulent entities in online social networks	08
III	**Controlled Information Sharing in Online Social Networks:** Access Control Models, Access Control in Online Social Networks, Relationship-Based Access Control, Privacy Settings in Commercial Online Social Networks, Existing Access Control Approaches	08
IV	**Identity Management in Online Social Networks:** Identity Management,	08

	Digital Identity, Identity Management Models: From Identity 1.0 to Identity 2.0, Identity Management in Online Social Networks, Identity as Self-Presentation, Identity thefts, Open Security Issues in Online Social Networks	
V	**Case Study:** Privacy and security issues associated with various social media such as Facebook, Instagram, Twitter, LinkedIn etc.	08

Text Book:

1. Security and Privacy-Preserving in Social Networks, Editors: Chbeir, Richard, Al Bouna, Bechara (Eds.), Spinger, 2013.
2. Security and Trust in Online Social Networks, Barbara Carminati, Elena Ferrari, Marco Viviani, Morgan & Claypool publications.
3. Security and Privacy in Social Networks, Editors: Altshuler, Y., Elovici, Y., Cremers, A.B., Aharony, N., Pentland, A. (Eds.), Springer, 2013.

Reference Book:

1. Security and privacy preserving in social networks, Elie Raad & Richard Chbeir, Richard Chbeir & Bechara Al Bouna, 2013
2. Social Media Security: Leveraging Social Networking While Mitigating Risk, Michael Cross, 2013.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Able to understand working of online social networks.
CO2: Describe privacy policies of online social media.
CO3: Analyse countermeasures to control information sharing in Online social networks.
CO4: Apply knowledge of identity management in Online social networks.
CO5: Compare various privacy and security issues associated with popular social media.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Soft Computing**
Course Code: MCA-032	**Title: Soft Computing**

Course Objectives:

CO1: Recognize the need of soft computing and study basic concepts and techniques of soft computing.
CO2: Understand the basic concepts of artificial neural network to analyze widely used neural networks.
CO3: Apply fuzzy logic to handle uncertainty in various real-world problems.
CO4: Study various paradigms of evolutionary computing and evaluate genetic algorithm in solving optimization problems.
CO5: Apply hybrid techniques in applications of soft computing.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Soft Computing:** Introduction, Comparison with hard computing, Concept of learning and adaptation, Constituents of soft computing, Applications of soft computing. **Artificial Neural Networks:** Basic concepts of neural networks, Human brain, Biological neural network, History of artificial neural networks, Basic building blocks of an artificial neuron, Neural network architectures, Activation functions, Characteristics and limitation of neural networks.	08
II	**Artificial Neural Networks:** Learning methods - Supervised, Unsupervised, Reinforcement, Hebbian, Gradient descent, Competitive, Stochastic. **Major classes of neural networks:** Perceptron networks, Multilayer perceptron model, Back-propagation network, Radial basis function network, Recurrent neural network, Hopfield networks, Kohonen self-organizing feature maps.	08
III	**Fuzzy Logic:** Introduction to Fuzzy Logic, Comparison with crisp logic, Properties of classical sets, Operations on classical sets, Properties of fuzzy sets, Operations on fuzzy sets, Classical relations, Fuzzy relations, Features and types of fuzzy membership functions, Fuzzy arithmetic, Fuzzy measures. **Fuzzy Systems:** Crisp logic, Predicate logic, Fuzzy logic, Fuzzy propositions,	08

	Inference rules, Fuzzy inference systems-Fuzzification, Inference, Defuzzification, Types of inference engines.	
IV	**Evolutionary Computing:** Introduction, Evolutionary algorithm, Biological evolutionary process, Paradigms of evolutionary computing – Genetic algorithm and Genetic programming, Evolutionary strategies, Evolutionary programming. **Genetic Algorithm:** Introduction, Traditional optimization and search techniques, Comparison with traditional algorithms, Operations- Encoding, Selection, Crossover and Mutation, Classification of Genetic algorithm.	08
V	**Hybrid Soft Computing Techniques:** Introduction, Classification of hybrid systems, Neuro-fuzzy hybrid systems, Neuro-genetic hybrid systems, Fuzzy-genetic hybrid systems. **Other Soft Computing Techniques:** Tabu Search, Ant colony-based optimization, Swarm Intelligence.	08

Text Book:

1. Sivanandam S.N. and Deepa S.N., "Principles of Soft Computing", Wiley-India.
2. Rajasekaran S. and Vijaya Lakshmi Pai G.A., "Neural Networks, Fuzzy Logic and Genetic Algorithms- Synthesis and Applications", PHI Learning.
3. Chakraverty S., Sahoo D.M. and Mahato N. R., "Concepts of Soft Computing- Fuzzy and ANN with Programming", Springer.

Reference Book:

1. Kaushik S. and Tiwari S., "Soft Computing – Fundamentals, Techniques and Applications', McGrawHill Education.
2. Jang J.-S.R., Sun C.-T. and Mizutani E., "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Recognize the need of soft computing and study basic concepts and techniques of soft computing.
CO2: Apply neural networks, bidirectional associative memories and adaptive resonance theory for solving different engineering problems
CO3: Identify and describe soft computing techniques and build supervised learning and unsupervised learning networks.
CO4: Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
CO5: Evaluate and compare solutions by various soft computing approaches for a given problem.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Pattern Recognition**
Course Code: MCA-033	**Title: Pattern Recognition**

Course Objectives:

CO1: Study of basics of Pattern recognition. Understand the designing principles and Mathematical foundation used in pattern recognition.
CO2: Analysis the Statistical Patten Recognition.
CO3: Understanding the different Parameter estimation methods.
CO4: Understanding the different Nonparametric Techniques.
CO5: Understand and Make use of unsupervised learning and Clustering in Pattern recognition.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi Squared test.	08
II	**Statistical Patten Recognition:** Bayesian Decision Theory, Classifiers, Normal density and discriminant functions	08
III	**Parameter estimation methods:** Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.	08
IV	**Nonparametric Techniques:** Density Estimation, Parzen Windows, K-Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification.	08
V	**Unsupervised Learning & Clustering:** Criterion functions for clustering, Clustering Techniques: Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.	08

Text Book:

1. Duda R. O., Hart P. E. and Stork D. G., "Pattern Classification", John Wiley.
2. Bishop C. M., "Neural Network for Pattern Recognition", Oxford University Press.

Reference Book: 1. Singhal R., "Pattern Recognition: Technologies & Applications", Oxford University Press. 2. Theodoridis S. and Koutroumbas K., "Pattern Recognition", Academic Press.	
Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	20 - - 10 70
Total:	**100**
Prerequisites for the course: NIL	
Course Learning Outcomes: CO1: Study of basics of Pattern recognition. Understand the designing principles and Mathematical foundation used in pattern recognition. CO2: Outline basic concepts of pattern recognition. CO3: Classify decision-making algorithms in pattern recognition. CO4: Apply Hierarchical and Partition clustering techniques in pattern recognition applications. CO5: Analyze feature selection algorithms in pattern recognition.	

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Data Analytics**
Course Code: MCA-034	**Title: Data Analytics**

Course Objectives:
CO1: Describe the life cycle phases of Data Analytics through discovery, planning and building.
CO2: Understand and apply Data Analysis Techniques.
CO3: Implement various Data streams.
CO4: Understand item sets, Clustering, frame works & Visualizations.
CO5: Apply R tool for developing and evaluating real time applications.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Data Analytics**: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. **Data Analytics Lifecycle**: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization	08
II	**Data Analysis:** Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, Neural Networks: Learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	08
III	**Mining Data Streams:** Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – Real time sentiment analysis, stock market predictions.	08

IV	**Frequent Item sets and Clustering:** Mining frequent item sets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent item sets in a stream, Clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in non-euclidean space, clustering for streams and parallelism.	08
V	**Frame Works and Visualization**: Map Reduce, Hadoop, Pig, Hive, H Base, Map R, Sharding, No SQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications. **Introduction to R** - R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data.	08

Text Book:

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer.
2. An and Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press.

Reference Book:

1. Bill Franks, "Taming the Big Data Tidalwave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & Sons.
2. John Garrett, "Data Analytics for IT Networks: Developing Innovative Use Cases", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand the concepts of visualization.
CO2: Explain and Analyse the Big Data using Map-reduce programming in Both Hadoop and Spark frame work.
CO3: Demonstrate spark programming and graph algorithms using programming languages.
CO4: Analyse and implement different frame work tools by taking sample data sets.
CO5: Illustrate and implement the concepts by taking an application problem

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Artificial Intelligence**
Course Code: MCA-036	**Title: Artificial Intelligence**

Course Objectives:

CO1: Define the meaning of intelligence and study various intelligent agents.
CO2: Understand, analyze and apply AI searching algorithms in different problem domains.
CO3: Study and analyze various models for knowledge representation.
CO4: Understand the basic concepts of machine learning to analyze and implement widely used learning methods and algorithms.
CO5: Understand the concept of pattern recognition and evaluate variousclassification and clustering techniques

Nature of Paper: Core Course

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Artificial Intelligence:** Introduction to artificial intelligence, Historical development and foundation areas of artificial intelligence, Tasks and application areas of artificial intelligence. Introduction, types and structure of intelligent agents, Computer Vision, Natural language processing.	08
II	**Searching Techniques:** Introduction, Problem solving by searching, Searching for solutions, Uniformed searching techniques, Informed searching techniques, Local search algorithms, Adversarial search methods, Search techniques used in games, Alpha-Beta pruning.	08
III	**Knowledge Representation and Reasoning:** Propositional logic, Predicate logic, First order logic, Inference in first order logic, Clause form conversion, Resolution. Chaining- concept, forward chaining and backward chaining, Utility theory and Probabilistic reasoning, Hidden Markov model, Bayesian networks.	08
IV	**Machine Learning:** Introduction, types and application areas, Decision trees, Statistical learning methods, Learning with complete data - concept and Naïve Bayes models, Learning with hidden data- concept and EM algorithm, Reinforcement learning.	08
V	**Pattern Recognition:** Introduction and design principles, Statistical pattern recognition, Parameter estimation methods - Principal component analysis and	08

	Linear discrimination analysis, Classification techniques - Nearest neighbor rule and Bayes classifier, K-means clustering, Support vector machine.	

Text Book:

1. Russell S. and Norvig P., "Artificial Intelligence – A Modern Approach", Pearson Education.
2. Rich E. and Knight K., "Artificial Intelligence", McGraw Hill Publications.
3. Charnik E. and McDermott D., "Introduction to Artificial Intelligence", Pearson Education.
4. Patterson D. W., "Artificial Intelligence and Expert Systems", Prentice Hall of India Publications.

Reference Book:

1. Khemani D., "A First Course in Artificial Intelligence", McGraw Hill.
2. Winston P. H., "Artificial Intelligence", Pearson Education.
3. Thornton C. and Boulay B.," Artificial Intelligence- Strategies, Applications and Models through Search", New Age International Publishers.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination tasks	15
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	75
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Demonstrate fundamental understanding of the history of artificial intelligence.
CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO4: Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
CO5: Demonstrate proficiency in applying scientific method to models of machine learning.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Block chain Architecture**
Course Code: MCA-041	**Title: Block chain Architecture**

Course Objectives:
CO1: Study and understand basic concepts of block chain architecture.
CO2: Analyze various requirements for consensus protocols.
CO3: Apply and evaluate the consensus process.
CO4: Understand the concepts of Hyper ledger fabric.
CO5: Analyze and evaluate various use cases in financial software and supply chain.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Block chain:** Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. **Block chain Architecture and Design:** Basic crypto primitives: Hash, Signature, Hash chain to Block chain, Bit coin Basic, Basic consensus mechanisms.	08
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Block chain consensus protocols, distributed consensus, consensus in Bit coin. **Permissioned Block chains:** Design goals, Consensus protocols for Permissioned Block chains	08
III	**Hyper ledger Fabric:** Decomposing the consensus process, Hyper ledger fabric components. **Chain code Design and Implementation Hyper ledger Fabric:** Beyond Chain code: fabric SDK and Front End, Hyper ledger composer tool.	08
IV	**Use case 1:** Block chain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance. **Use case 2:** Block chain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.	08
V	**Use case 3:** Block chain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems, Block chain Cryptography,	08

	Privacy and Security on Block chain.	

Text Book:

1. Andreas Antonopoulos, "Mastering Bit coin: Unlocking Digital Crypto currencies", O' Reilly
2. Melanie Swa, "Block chain", O' Reilly

Reference Book:

1. "Hyper ledger Fabric", https://www.hyperledger.org/projects/fabric
2. Bob Dill, David Smits, "Zero to Block chain - An IBM Redbooks course", https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination	20
2. Presentations /Seminar	-
3. Assignments	-
4. Research Project Report Seminar On Research Project Report	10
5. ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe the basic concepts and technology used for block chain.
CO2: Describe the primitives of the distributed computing and cryptography related to block chain.
CO3: Illustrate the concepts of Bit coin and their usage.
CO4: Implement Ethereum block chain contract.
CO5: Apply security features in block chain technologies.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Neural Networks**
Course Code: MCA-042	**Title: Neural Networks**

Course Objectives:

CO1: Study of basic concepts of Neuro Computing, Neuroscience and ANN. Understand the different supervised and unsupervised and neural networks performance.

CO2: Study of basic Models of neural network. Understand the Perception network and Compare neural networks and their algorithm.

CO3: Study and demonstrate different types of neural network. Make use of neural networks for specified problem domain.

CO4: Understand and identify basic design requirements of recurrent network and Self- organizing feature map.

CO5: Able to understand some special network. Able to understand the concept of Soft computing.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Neuro computing and Neuroscience**: The human brain, biological neurons, neural processing, bio logical neural network. **Artificial Neural Networks:** Introduction, historical notes, neuron model, knowledge representation, comparison with biological neural network, applications. **Learning process:** Supervised learning, unsupervised learning, error correction learning, competitive learning, adaptation learning, Statistical nature of the learning process.	08
II	**Basic Models:** Mc Culloch-Pitts neuron model, Heb b net, activation functions, aggregation functions. **Perceptron networks:** Perceptron learning, single layer perceptron networks, multilayer perceptron networks. Least mean square algorithm, gradient descent rule, nonlinearly separable problems and bench mark problems in NN.	08
III	**Multilayer neural network:** Introduction, comparison with single layer networks. **Back propagation network**: Architecture, back propagation algorithm, local minima and global minima, heuristics for making back	08

	propagation algorithm performs better, applications. **Radial basis function network**: Architecture, training algorithm, approximation properties of RBF networks, comparison of radial basis function network and back propagation networks.	
IV	**Recurrent network**: Introduction, architecture and types. **Self-organizing feature map**: Introduction, determining winner, Kohonen Self Organizing feature maps (SOM) architecture, SOM algorithm, properties of feature map; Learning vector quantization-architecture and algorithm. Principal component and independent component analysis.	08
V	**Special networks:** Cognitron, Support vector machines. Complex valued NN and complex valued BP. **Soft computing:** Introduction, Overview of techniques, Hybrid soft computing techniques.	08

Text Book:

1. Kumar S., "Neural Networks- A Classroom Approach", McGraw Hill.
2. Haykin S., "Neural Networks – A Comprehensive Foundation", Pearson Education.
3. Yegnanarayana B. "Artificial Neural Networks", Prentice Hall of India.

Reference Book:

1. Freeman J. A., "Neural Networks", Pearson Education.
2. James F., "Neural Networks – Algorithms, Applications and Programming Techniques", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand the need and significance of mathematical fundamentals in pattern recognition to solve real-time problems.
CO2: Explore on supervised learning algorithms and to apply them for solving problems.
CO3: Apply unsupervised techniques for clustering data without prior knowledge.
CO4: Design pattern recognition models to extract interesting patterns from structured data like graph, syntactic description etc.
CO5: Understand the impact of dimensionality reduction on the design of intelligent models and to apply the dimensionality reduction techniques on data.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Modern Application Development**
Course Code: MCA-044	**Title: Modern Application Development**

Course Objectives:

CO1: Understand the fundamental of Kotlin Programing for Android Application Development.
CO2: Describe the UI Layout and architecture of Android Operating System.
CO3: Designing android application using Jetpack Library based on MVVM Architecture.
CO4: Developing android application based on REST API using Volley and Retrofit Library.
CO5: Ability to debug the Performance and Security of Android Applications.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 4 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Kotlin Fundamental:** Introduction to Kotlin, Basic Syntax, Idioms, Coding Conventions, Basics, Basic Types, Packages, Control Flow, Returns and Jumps, Classes and Objects, Classes and Inheritance, Properties and Fields, Interfaces, Visibility Modifiers, Extensions, Data Classes, Generics, Nested Classes, Enum Classes, Objects, Delegation, Delegated Properties, Functions and Lambdas, Functions, Lambdas, Inline Functions, Higher-Order Functions, Scope Functions, Collections, Ranges, Type Checks and Casts, This expressions, Equality, Operator overloading, Null Safety, Exceptions, Annotations, Reflection.	08
II	**Android Fundamental: Android Architecture**: Introduction to Android, Layouts, Views and Resources, Activities and Intents, Activity Lifecycle and Saving State, Implicit or Explicit Intents. **User Interaction and Intuitive Navigation:** Material Design, Theme, Style and Attributes, Input Controls, Menus, Widgets, Screen Navigation, Recycler View, List View, Adapters, Draw ables, Notifications.	08
III	**Storing, Sharing and Retrieving Data in Android Applications:** Overview to storing data, shared preferences, App settings, Store and query data in Android's SQ Lite database, Content Providers, Content Resolver, Loading data using loaders. **Jetpack Components:** Fragments, Jetpack Navigation, Lifecycle, Lifecycle Observer, Lifecycle Owner, View Model, View Model Factory, View Model	08

	Provider, Live Data, Room API, Data Binding, View Binding, MVVM Architecture Basics	
IV	**Asynchronous Data Handling, Networking and Files:** Asynchronous Task, Co routines, API Handling, JSON Parsing, Volley Library, Retrofit Library, File Handling, HTML and XML Parsing, Broadcast receivers, Services	08
V	**Permissions, Performance and Security:** Firebase, Ad Mob, APK Singing, Publish App, Packaging and deployment, Google Maps, GPS and Wi-Fi, Download Manager, Work Manager, Alarms, Location, Map and Sensors, APK Singing, Publish App	08

Text Book:

1. Meier R.,"Professional Android 2 Application Development", Wiley.
2. Hashimi S., Komatineni S. And Mac Lean D., "Pro Android 2", Apress.
3. Murphy M., "Beginning Android 2", Apress.

Reference Book:

1. Delessio C. and Darcey L., "Android Application Development", Pearson Education.
2. DiMarzio J.F., "Android a Programming Guide", Tata Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe principles, techniques and usage of modern software development process.
CO2: Solve problems related to real world application development.
CO3: Use standard practices to develop modern application.
CO4: Implement recent devices to develop application.
CO5: Evaluate modern trends of software development

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Distributed Database Systems**
Course Code: MCA-045	**Title: Distributed Database Systems**

Course Objectives:
CO1: Understand theoretical and practical aspects of distributed database systems.
CO2: Study and identify various issues related to the development of distributed database system.
CO3: Understand the design aspects of object-oriented database system and related development.
CO4: Equip students with principles and knowledge of distributed reliability.
CO5: Equip students with principles and knowledge of parallel and object-oriented databases.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Distributed Data Processing, Distributed Database System, Promises of DDBSs, Problem areas. Distributed DBMS Architecture: Architectural Models for Distributed DBMS, DDMBS Architecture. Distributed Database Design: Alternative Design Strategies, Distribution Design issues, Fragmentation, Allocation.	08
II	**Query processing and decomposition:** Query processing objectives, characterization of query processors, layers of query processing, query decomposition, localization of distributed data. Distributed query Optimization: Query optimization, centralized query optimization, distributed query optimization algorithms.	08
III	Transaction Management: Definition, properties of transaction, types of transactions, distributed concurrency control: Serializability, concurrency control mechanisms & algorithms, time - stamped & optimistic concurrency control Algorithms, deadlock Management.	08
IV	**Distributed DBMS Reliability:** Reliability concepts and measures, fault-tolerance in distributed systems, failures in Distributed DBMS, local & distributed reliability protocols, site failures and network partitioning. Parallel Database Systems: Parallel database system architectures, parallel data placement, parallel query processing, load balancing, database clusters.	08
V	**Distributed object Database Management Systems:** Fundamental object	08

	concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing. **Object Oriented Data Model:** Inheritance, object identity, persistent programming languages, persistence of objects, comparison OODBMS and ORDBMS	

Text Book:

1. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2001.
2. Stefano Ceri and Giuseppe Pelagatti: Distributed Databases, Mc Graw Hill.

Reference Book:

1. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom: "Database Systems: The Complete Book", Second Edition, Pearson International Edition.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Describe distributed database concept and architecture.
CO2: Compare the type of distributed database systems.
CO3: Display knowledge of the fragmentation in distributed database systems.
CO4: Understand of query processing, data and access control of distributed database systems.
CO5: Describe transaction management in distributed database systems

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Computer Graphics and Animation**
Course Code: MCA-052	**Title: Computer Graphics and Animation**

Course Objectives:
CO1: Understand the graphics hardware used in field of computer graphics.
CO2: Understand the concept of graphics primitives such as lines and circle based on different algorithms.
CO3: Apply the 2D graphics transformations, composite transformation and Clipping concepts.
CO4: Apply the concepts and techniques used in 3D computer graphics, including viewing transformations, projections, curve and hidden surfaces.
CO5: Perform the concept of multimedia and animation in real life.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction and Line Generation:** Types of computer graphics, Graphic Displays- Random scan displays, Raster scan displays, Frame buffer and video controller, Points and lines, Line drawing algorithms, Circle generating algorithms, Mid-point circle generating algorithm, and parallel version of these algorithms.	08
II	**Transformations:** Basic transformation, Matrix representations and homogenous coordinates, Composite transformations, Reflections and shearing. **Windowing and Clipping:** Viewing pipeline, Viewing transformations, 2-D Clipping algorithms- Line clipping algorithms such as Cohen Sutherland line clipping algorithm, Liang Barsky algorithm, Line clipping against nonrectangular clip windows; Polygon clipping – Sutherland Hodgeman polygon clipping, Weiler and Atherton polygon clipping, Curve clipping, Text clipping.	08
III	**Three Dimensional:** 3-D Geometric Primitives, 3-D Object representation, 3-D Transformation, 3-D viewing, projections, 3-D Clipping. **Curves and Surfaces:** Quadric surfaces, Spheres, Ellipsoid, Blobby objects, Introductory concepts of Spline, Bspline and Bezier curves and surfaces.	08
IV	**Hidden Lines and Surfaces:** Back Face Detection algorithm, Depth buffer	08

	method, A- buffer method, Scan line method, basic illumination models– Ambient light, Diffuse reflection, Specular reflection and Phong model, Combined approach, Warn model, Intensity Attenuation, Color consideration, Transparency and Shadows.	
V	**Multimedia Systems:** Design Fundamentals, Back ground of Art, Color theory overview, Sketching & illustration, Storyboarding, different tools for animation. **Animation:** Principles of Animations, Elements of animation and their use, Power of Motion, Animation Techniques, Animation File Format, Making animation for Rolling Ball, making animation for a Bouncing Ball, Animation for the web, GIF, Plugins and Players, Animation tools for World Wide Web.	08

Text Book:

1. Hearn D. and Baker M. P., "Computer Graphics C Version", Pearson Education
2. Foley, Vandam, Feiner, Hughes,"Computer Graphics principle", Pearson Education.
3. Rogers, " Procedural Elements of Computer Graphics", McGraw Hill

Reference Book:

1. Newman W. M., Sproull R. F., "Principles of Interactive computer Graphics", Mc Graw Hill.
2. Sinha A. N. and Udai A. D.," Computer Graphics", Mc Graw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand how to generate line, circle and ellipse also how to create 2D object and various transformation techniques.
CO2: Understand various 3D Transformation techniques using Open GL.
CO3: Understand multimedia compression techniques and applications.
CO4: Apply the concepts and techniques used in 3D computer graphics, including viewing transformations, projections, curve and hidden surfaces.
CO5: Perform the concept of multimedia and animation in real life.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Natural Language Processing**
Course Code: MCA-053	**Title: Natural Language Processing**

Course Objectives:
CO1: Study and understand basic concepts, background and representations of natural language.
CO2: Analyze various real-world applications of NLP.
CO3: Apply different parsing techniques in NLP.
CO4: Understand grammatical concepts and apply them in NLP.
CO5: Apply various statistical and probabilistic grammar methods to handle and evaluate ambiguity.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Natural Language Understanding:** The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.	08
II	Introduction to semantics and knowledge representation, some applications like machine translation, database interface.	08
III	Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top- Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.	08
IV	**Grammars for Natural Language:** Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.	08
V	**Ambiguity Resolution:** Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.	08

Text Book:

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal, "NLP: A Paninian Perspective", Prentice Hall, New Delhi.
2. James Allen, "Natural Language Understanding", Pearson Education.
3. D. Jurafsky, J. H. Martin, "Speech and Language Processing", Pearson Education.

Reference Book:

1. L. M. Ivansca, S. C. Shapiro, "Natural Language Processing and Language Representation", AAAI Press, 2000.
2. T. Winograd, Language as a Cognitive Process, Addison-Wesley.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.
CO2: Realize semantics and pragmatics of English language for text processing
CO3: Create CORPUS linguistics based on digestive approach (Text Corpus method)
CO4: Check a current method for statistical approaches to machine translation.
CO5: Perform POS tagging for a given natural language and select a suitable language modeling technique based on the structure of the language.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Machine Learning**
Course Code: MCA-054	**Title: Machine Learning**

Course Objectives:

CO1: To understand the need for machine learning for various problem solving
CO2: To understand a wide variety of learning algorithms and how to evaluate models generated from data
CO3: To understand the latest trends in machine learning
CO4: To design appropriate machine learning algorithms and apply the algorithms to a real-world problems
CO5: To optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**INTRODUCTION** – Learning, Types of Learning, Well defined learning problems, Designing a Learning System, History of ML, Introduction of Machine Learning Approaches – (Artificial Neural Network, Clustering, Reinforcement Learning, Decision Tree Learning, Bayesian networks, Support Vector Machine, Genetic Algorithm), Issues in Machine Learning and Data Science Vs Machine Learning;	08
II	**REGRESSION:** Linear Regression and Logistic Regression **BAYESIAN LEARNING -** Bayes theorem, Concept learning, Bayes Optimal Classifier, Naïve Bayes classifier, Bayesian belief networks, EM algorithm. **SUPPORT VECTOR MACHINE:** Introduction, Types of support vector kernel– (Linear kernel, polynomial kernel, and Gaussian kernel), Hyper plane – (Decision surface), Properties of SVM, and Issues in SVM.	08
III	**DECISION TREE LEARNING** - Decision tree learning algorithm, Inductive bias, Inductive inference with decision trees, Entropy and information theory, Information gain, ID-3 Algorithm, Issues in Decision tree learning. **INSTANCE-BASED LEARNING** – k-Nearest Neighbour Learning, Locally Weighted Regression, Radial basis function networks, Case-based learning.	08
IV	**ARTIFICIAL NEURAL NETWORKS**– Perceptron's, Multilayer	08

	perceptron, Gradient descent and the Delta rule, Multilayer networks, Derivation of Back propagation Algorithm, Generalization, Unsupervised Learning – SOM Algorithm and its variant; **DEEP LEARNING** - Introduction, concept of convolutional neural network , Types of layers – (Convolutional Layers , Activation function, pooling, fully connected), Concept of Convolution (1D and 2D) layers, Training of network, Case study of CNN for e.g. on Diabetic Retinopathy, Building a smart speaker, Self-deriving car etc.	
V	**REINFORCEMENT LEARNING**–Introduction to Reinforcement Learning , Learning Task, Example of Reinforcement Learning in Practice, Learning Models for Reinforcement – (Markov Decision process, Q Learning - Q Learning function, Q Learning Algorithm), Application of Reinforcement Learning, Introduction to Deep Q Learning. **GENETIC ALGORITHMS:** Introduction, Components, GA cycle of reproduction, Crossover, Mutation, Genetic Programming, Models of Evolution and Learning, Applications	08

Text Book:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), MIT Press2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

Reference Book:

1. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
2. M. Gopal, "Applied Machine Learning", McGraw Hill Education

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Learn the basics of learning problems with hypothesis and version spaces
CO2: Understand the features of machine learning to apply on real world problems
CO3: Characterize the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze the various algorithms of supervised and unsupervised learning
CO4: Analyze the concept of neural networks for learning linear and non-linear activation functions
CO5: Learn the concepts in Bayesian analysis from probability models and method.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Quantum Computing**
Course Code: MCA-055	**Title: Quantum Computing**

Course Objectives:

CO1: Distinguish problems of different computational complexity and explain why certain problems are rendered tractable by quantum computation with reference to the relevant concepts in quantum theory.
CO2: Demonstrate an understanding of a quantum computing algorithm by simulating it on a classical computer, and state some of the practical challenges in building a quantum computer.
CO3: Contribute to a medium-scale application program as part of a co-operative team, making use of appropriate collaborative development tools (such as version control systems).
CO4: Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.
CO5: Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Fundamental Concepts:** Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	08
II	**Quantum Computation**: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	08
III	**Quantum Computers:** Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance	08
IV	**Quantum Information:** Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum	08

	noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	
V	**Quantum Error Correction:** Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.	08

Text Book:

1. Micheal A. Nielsen. & Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition,2002.
2. Eleanor G. Rieffel, Wolfgang H. Polak, "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback –Import,3 Oct 2014
3. Computing since Democritus by Scott Aaronson

Reference Book:

1. Computer Science: An Introduction by N. David Mermin
2. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course:NIL

Course Learning Outcomes:

CO1: Able to access the quantum computing services provided by IBM, and other quantum computing services Simulators.

CO2: Able to think independently of quantum circuits, algorithm and applications for real-time stochastic problems in QC.

CO3: Trained to design QC circuits and reversible logics for real world problems.

CO4: Produce code and documentation that is comprehensible to a group of different programmers and present the theoretical background and results of a project in written and verbal form.

CO5: Apply knowledge, skills, and understanding in executing a defined project of research, development, or investigation and in identifying and implementing relevant outcomes.

Format-3

IIMT UNIVERSITY
Year: II / Semester: IV

Programme: Degree **Class: MCA(AIML)**	**Year: II** **Semester: IV**
Credits: 3 **Theory: 3** **Practical: 0**	**Subject: Internet of Things**
Course Code: MCA-056	**Title: Internet of Things**

Course Objectives:
CO1: Demonstrate basic concepts, principles and challenges in IoT.
CO2: Illustrate functioning of hardware devices and sensors used for IoT.
CO3: Analyze network communication aspects and protocols used in IoT.
CO4: Apply IoT for developing real life applications using Arduino programming.
CO5: To develop IoT infrastructure for popular applications

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks / 3 Credits (ISE+ESE)

L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)

Unit	Contents	No. of Lectures Allotted
I	**Internet of Things (IoT):** Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	08
II	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	08
III	**Network & Communication aspects in IoT:** Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	08
IV	**Programming the Arduino:** Arduino Platform Boards Anatomy, Arduino IDE, coding, using emulator, using libraries, additions in Arduino, programming the Arduino for IoT.	08
V	**Challenges in IoT Design challenges:** Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards,	08

	communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	

Text Book:

1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", willey
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson

Reference Book:

1. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
2. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications, 2014
3. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	-
3) Assignments	-
4) Research Project Report Seminar On Research Project Report	10
5) ESE	70
Total:	**100**

Prerequisites for the course: NIL

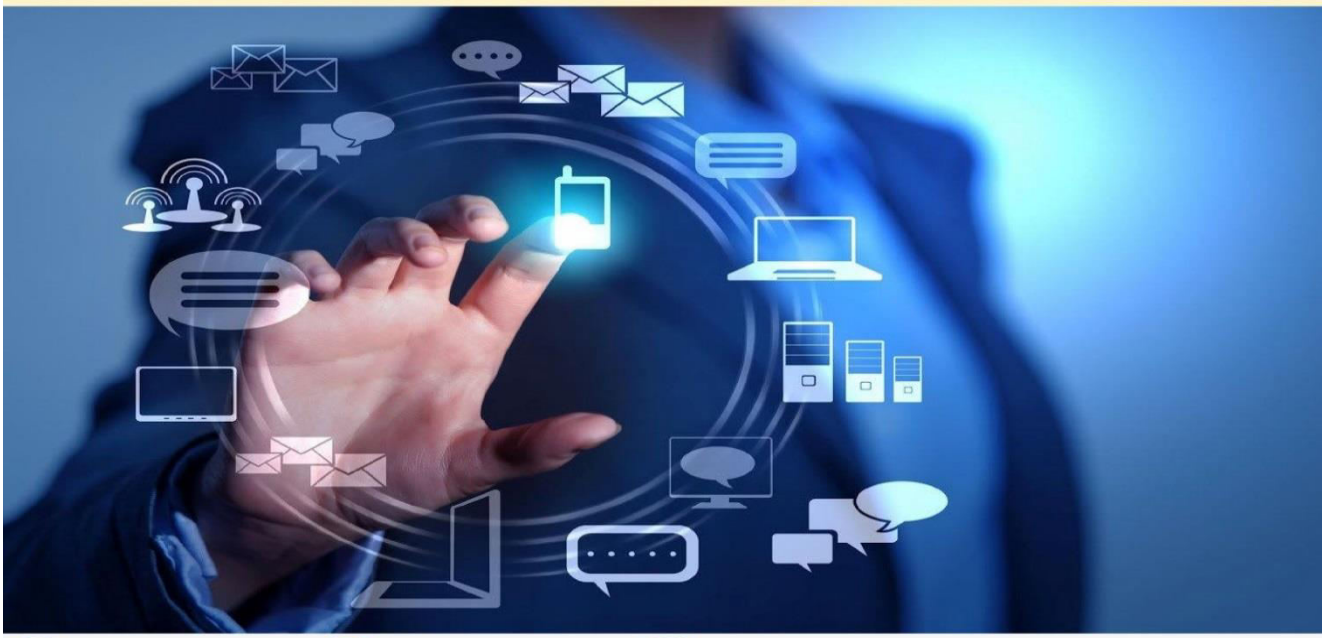
Course Learning Outcomes:

CO1: Able to understand the application areas of IOT
CO2: Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO3: Able to understand building blocks of Internet of Things and characteristics.
CO4: Apply IoT for developing real life applications using Arduino programming.
CO5: To develop IoT infrastructure for popular applications

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Ph.D. Program (Computer Science and Applications)
(Academic Session: 2025-26)

Index

1. Preamble
2. Definitions and Nomenclatures
3. Vision and mission of the school
4. Program Educational Objectives
5. Program outcome
6. Program Specific outcome
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10. Medium of Instruction
11. Choice base Credit system (CBCS)/LOCF/OBE
12. Registration for course in a semester
13. Attendance
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14. Assessment procedure
    - 14.1 Internal Assessment (IA) (External Assessment (EA)
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        - Internal Assessment (IA) (External Assessment (EA)
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17. For non – credit courses / audit courses
18. Credit weightage
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20. Maximum gaps between semester/year
21. Credit system & grading CGPA/SGPA
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24. Change of discipline
25. Use of technological intervention
26. Student Discipline
27. Student Welfare
28. Ragging
29. Power of modify
30. Exit point
31. NC/Credit Course

Vision

To be a world - class university imparting knowledge and values and providing students, an excellent learning experience through research & innovation in the field of Science, Technology, Management and other areas that will meet the aspirations of world community.

Mission

University stands for academic, professional and ethical empowerment of the youths by using the state-of-the-art technology, time-tested and innovative concepts, excellent infrastructure and internationally acclaimed facilitators.

IMPORTANT NOTES

Ph.D. Manual download

https://iimtu.edu.in/uploads/images/16704069111.pdf
(Eligibility criteria, Minimum Standards and Procedures for Award of Ph.D. Degree)

Ph.D. Forms download

https://iimtu.edu.in/page/phd-forms

Ph.D. Admission Guidelines

https://iimtu.edu.in/page/phd-admission-guidelines-iimtu

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Evaluation Scheme

Ph.D. (Computer Science and Applications)

Evaluation Scheme

S.No.	Code	Subject Name	Periods		Evaluation Scheme		Total	Credits
			L	T/P	Internal	External		
1.	PHDCS-101 (Core Theory)	Advanced Research Methodology	4		30	70	100	4
2.	PHDCS-102 (Core Theory)	Review of Literature	4		30	70	100	4
3.	PHDCS-103 (E-Elective) (Discipline Specific)	**(Area of Research)** PHDCS-103 **(I)** Network Security & Cryptography PHDCS-103 **(II)** Cloud Computing PHDCS-103 **(III)** Soft Computing PHDCS-103 **(IV)** Machine Learning PHDCS-103**(V)** Internet of Things	4		30	70	100	4
4.	CPE-RPE -104 (Core Theory)	Research and Publication Ethics	2		20	30	50	2
5.	PHDCS-105 (Discipline Specific)	Seminar / Presentation	2		50	0	50	2
	Total		**16**		**160**	**240**	**400**	**16**

Note: - *At Sr. No.3 Scholar has to select any one subject as per her/his area of research.*

Course Detail	PAPER-I: Advanced Research Methodology PHDCS-101
Core Theory	Detail Syllabus

Sessional Marks: 30

Exam Marks: 70

OBJCTIVES OF THE COURSE:

- To learn the art of Literature Review and to focus on a research problem using scientific methods.
- To inculcate analytical thinking and data interpretation capability.
- To enable to apply the fundamental laws of performance analysis to establish the relationships between workload parameters and system performance for a given system.
- To learn how to synthesize and communicate research findings to a wide range of audiences.

UNIT-I

Formulating Research Problem and Conceptualizing a Research Design:
Meaning of research problem, Sources of research problem, Criteria/Characteristics of a good research problem, Scope and objectives of research problem. Reviewing the literature, formulating a research problem, identifying variables, constructing hypotheses, Errors in selecting a research problem. Research design: Objectives, Strategies, Guidelines for design of experiments. Selecting a study design.

UNIT-II

Research Modeling: Types of Models, Model building and stages, Data consideration and testing Heuristic and Simulation modeling. Mathematical Modeling and Simulation: Important of modeling and simulation, Continuous and discrete models and simulation, Model validation, verification and credibility. Modeling Principles: Fundamental laws, Monte Carlo simulation, stochastic state transition systems.

UNIT-III

Research Tools: Tools needed for Editing, Presentation, Data Analysis and visualization, Simulation and Modeling. Analysis, Design and Simulation tools related to specialization. Searching: Using advanced search technique for searching research materials in online repositories/consortium, like inflibnet, Indest, Scopus, etc.

UNIT-IV

Developing a Research Proposal: Format of research proposal, Individual research proposal. Institutional proposal, Proposal of a student – a presentation and assessment by a review committee consisting of Guide and external expert only. Report writing and Publishing Research Findings: Pre-writing considerations, Formats of report writing, Formats of publications in Research journals. Writing a research report/thesis.
Plagiarism: Introduction of Plagiarism, Dimension of Plagiarism, Detect Plagiarism, Strategies to Minimize Plagiarism

Recommended Text books:

1. "Research Methodology-Methods and Techniques", by C.K. Kothari (2004), New Age International, New Delhi.

2. "Research Methodology: A Step-by-Step Guide for Beginners", by Ranjit Kumar (2005), Pearson India
3. "Elements of Research Writing", by Dr. S.K. Yadav (2015), UDH Publishers & Distributors, Pvt. Ltd. New Delhi
4. "Applied Statistics & Probability for Engineers", by Douglas C. Montgomery and George C. Runger (2007), Wiley India.
5. "Theory of modeling and simulation integration discrete event and continuous complex dynamic systems", by Bernard P. Zeigher, Herbert Praehofer, Tag Gon Kim (2000), Academic Press.

Course Detail	PAPER-II: REVIEW OF LITERATURE PHDCS-102
Core Theory	Detail Syllabus

Sessional Marks: 30

Exam Marks: 70

OBJCTIVES OF THE COURSE:

- To learn the art of Literature Review and to focus on a research problem using scientific methods.
- To inculcate old methodologies and developing capacity of understand already work done.
- To enable to apply the fundamental laws of performance of their research work.
- To learn how to synthesize and communicate old research findings to their work of research.

The research scholar will review the important studies conducted at the national and international level either by individuals or organizations including government agencies and present the methodology adopted and important findings emerged from these studies. Based on this review of literature the researcher will identify the research gaps existing in the available literature and thus justifying the need for the present study.
The researcher is supposed to follow the pattern adopted in the standard national and international research journals.

Recommended Textbooks and References:

1. Dharwadkar, Vinay, ed. Collected Essays of A. K. Ramanujan. Delhi: Oxford University Press, 1999.
2. During, Simon, ed. The Cultural Studies: Reader. London: Routledge, 1993.
3. Fanon, Frantz. The Wretched of the Earth. London: Penguin Books, 1963.
4. Zizek, Slavoj. Mapping Ideology. London: Verso, 1994.
5. Agger, Ben. Cultural Studies as Critical Theory. London: The Palmer Press, 1992.
6. Nicol, Bran, ed. Postmodernism and the Contemporary Novel: A Reader. Edinburg: Edinburg University Press, 1992.
7. Lodge, David, ed. Modern Criticism and Theory: A Reader. London: Longman, 1988.
8. Bulletin of the American Academy of Arts and Sciences, Vol. 43, No. 4 (Jan., 1990), pp. 11-34
9. Mikhail Bakhtin. Problems of Doestoev sky's Poetics. Trans. Caryl Emerson, Manchester: Manchester Univ. Press, 1984.
10. The American Historical Review, Vol. 99, No. 5 (Dec., 1994), pp. 1475-1490.
11. Barker, Chris. Cultural Studies: Theory and Practice. London: Sage, 2011.

Course Detail	PAPER-III: Network Security and Cryptography (Elective) PHDCS-103(I)
(Area of Research)	Detail Syllabus

Sessional Marks: 30

Exam Marks: 70

UNIT-I

Introduction to Information Security and Number theory What is Information Security, Need of Information Security; Security Architecture Data Security; Security Goals: Confidentiality, Integrity, Availability; Attacks on Security; Active vs. Passive Attacks; Authentication; Access Control; Non-Repudiation; Steganography; Basics of Cryptography; Cryptanalysis; Digital signatures; Public-key cryptography; Cryptographic Hash functions. Mathematical induction, Binomial Number theorem, Elementary Number Theory, Integer Arithmetic, Modular Arithmetic, Factorization, Exponentiation and Logarithm, Primes, Matrices, Groups, Rings, Fields, Finite Fields; Cryptography background;

UNIT-II

Cryptographic techniques and Cryptanalysis Symmetric Cryptography, Data Encryption Standard (DES), Triple-DES, the Advanced Encryption Standard (AES), International Data Encryption Algorithm (IDEA), Blowfish, C4, RC5, RC6, Asymmetric Cryptography, The Diffie-Hellman Algorithm, RSA, Elliptic Curve Cryptosystems (ECC)

UNIT-III

Latest Security Technologies SDN (Software-defined Networking), Virtual Dispersive Networking (VDN), Smart Grid Technologies, SAML & The Cloud, Distributed Ledger Technology principles, Blockchain, Advanced analytics, Context-Aware Behavioral Analytics, Deep learning, Gartner's CARTA approach, Bioprinting, Mobile Location Tracking, Behavioral Profiles, Third-Party Big Data, External Threat Intelligence, Tailor-made security, Early Warning Systems, Hardware authentication.

UNIT-IV

Security in Cloud and Distributed Systems The cloud computing and distributed systems concepts and models: virtualization, cloud storage: key-value/No SQL stores, cloud networking, Consensus in Cloud Computing, FLP proof, fault-tolerance in cloud using PAXOS, peer-to-peer systems, classical distributed algorithms, leader election, time, ordering in distributed systems, distributed mutual exclusion, distributed algorithms for failures and recovery approaches, Security As a Service, Distributed Ledger Technology principles, Block chain, Apache Spark, Google's Chubby, Apache Zookeeper, H Base, Map Reduce, Apache Cassandra, Google's B4, Microsoft's Swan

Recommended Textbooks:

1. "Elementary Number Theory" by David M. Burton, Tata Mc Graw Hill Publication
2. "A Course in number theory and cryptography" by Neal Koblilz, Springer-Verlag Publication.
3. "Cryptography & Network Security" by Behrouz Forouzan, Tata Mc Graw-Hill.

4. "Handbook of Applied Cryptography" by A. Menezes, P. van Oorschot, and S. Vanstone, CRC Press, 1996.
5. "Cryptography and Network Security" by William Stallings, Pearson Education India, 2008.
6. "Understanding Cryptography" by Christ of Paar & Jan Pelzl, Springer Heidelberg Dordrecht, London New York, 2010.
7. "Block chain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World.", 2016. Print, Tapscott, Don, and Alex Tapscott.
8. "Big Data Analytics in Cyber security (Data Analytics Applications)"by OnurSavas (Editor),
9. "Cloud Computing: Principles and Paradigms", by Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011.
10. "Distributed Computing: Principles, Algorithms, & Systems" by Ajay D. Kshemkalyani & Mukesh Singhal.

References:

1. "Applied Cryptography" by Bruce Schneier, John Willley and Sons Inc, 2008
2. "Complexity and Cryptography: An Introduction" by John Talbot & Dominic Welsh, Cambridge University Press 2006
3. "Computer security and cryptography" by Alan g. Konheim, John Wiley & Sons, Inc., 2007
4. "Cryptography and Data Security" by Dorothy Elizabeth and Robling Denning' Addison Wesley Publishing Company, 1982
5. "An Introduction to Mathematical Cryptography" by Jeffrey Hoffstein, Jill Pipher, Joseph H., Silverman, Springer Publication
6. "The Code Book: The Science of Secrecy from Ancient Egypt to Quantum Cryptography" by Simon Singh, Anchor Books Publication
7. http://www.ecrypt.eu.org/
8. http://www.iacr.org/
9. https://www.cyberdegrees.org/resources/hot-technologies-cyber-security/

Course Title	PAPER–III Cloud Computing (Elective) COURSE PHDCS-103(II)
Discipline Specific	Detail Syllabus

Sessional Test: 30

Final Exam: 70

UNIT-I

Cloud Computing definition, private, and public and hybrid cloud. Cloud types; Cloud Computing model, laaS, PaaS, SaaS, Benefits and challenges of cloud computing, public vs private clouds, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery; next generation Cloud Applications. Difference between mainframe computing, distributed computing, cloud computing, grid computing, and green computing. Limitation of cloud computing, Issues on cloud computing.

UNIT-II

Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Economics of choosing a Cloud platform for an organization, based on application requirement, economic constraints and business needs (e.g. Amazon, Microsoft and Google, Salesforce.com, Ubuntu and Red hat).

UNIT-III

Cloud computing load balancing algorithms, Different types of load balancing in cloud computing, Cloud Computing load balancing Comparison with DNS Load Balancing, Importance of Load Balancing in cloud computing, Load Balancing Techniques in cloud computing, Scheduling Algorithms, Load Balancing Policies, A Comparative Study of Algorithms, Client-side Load Balancer Using Cloud, cloud load balancing services, cloud load balancers, Various resource allocation strategies in cloud computing, Comparison of load balancing algorithms used in cloud computing, Load balancing issues among multifarious issues of cloud computing environment, Load balancing in cloud computing using soft computing technique's, Load balancing in public cloud by division of cloud based on the geographical location,

UNIT-IV

Literature Review: A review of Cloud computing load balancing algorithms. A review of cloud computing load balancing strategies. A survey on cloud computing load balancing techniques. A Survey on cloud computing load balancing tools.

Books & References:

1. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" Mc

Graw-Hill Osborne Media; 1st edition [ISBN: 0071626948], 2009.
3. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 1st edition, ISBN1439834539, 2010.
4. Chee, Brian J.S. (2010). Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center. CRC Press. ISBN 9781439806173.
5. Shatz, Gur (15 October 213). "Bringing Layer 7 Load Balancing into the Cloud". Incapsula. Retrieved 30 January 2014.
6. Randles, Martin, David Lamb, and A. Taleb-Bendiab. "A comparative study into distributed load balancing algorithms for cloud computing". Advanced Information Networking and Applications
7. Workshops (WAINA), 2010 IEEE 24th International Conference on IEEE, 2010.
8. Ferris, James Michael. "Methods and Systems for load balancing in cloud-based networks". US Patent Application 12/127, 926.

Course Title	PAPER–III: SOFT COMPUTING (Elective) PHDCS-103(III)
Discipline Specific	Detail Syllabus

Sessional Marks: 30

Exam Marks: 70

UNIT-I

Introduction to Soft Computing: Introduction to Fuzzy Computing, Neural Computing, Genetic Algorithms, Probabilistic Networks, Associative Memory, Deep learning, Adaptive Resonance Theory, SWARM Intelligence etc. Applications of Soft Computing in Pattern Recognition, Computer Vision, Natural Language Processing, Multimodal Information Access & Retrieval, Multisource Data Analysis, Image Processing, Video Analysis, Data Clustering etc.

UNIT-II

Fundamentals of Neural Network: Introduction to Artificial Neuron, Architectures, Learning Methods, Taxonomy of NN Systems, Single-Layer NN System, Applications. Back Propagation Network: Background, Back-Propagation Learning, Back-Propagation Algorithm. Associative Memory and Adaptive Resonance Theory.

UNIT-III

Fuzzy Set Theory: Introduction to Fuzzy Set: Membership, Operations, Properties; Fuzzy Relations. Fuzzy Systems: Introduction, Fuzzy Logic, Fuzzification, Fuzzy Inference, Fuzzy Rule Based System, Defuzzification.

UNIT=IV

Genetic Algorithms & Modeling: Introduction to Encoding techniques, Operators of Genetic Algorithms, Basic Genetic Algorithms, and Hybrid Systems: Integration of NN, GA and FS. Introduction to SVM, SOM, Supervised & Unsupervised learning, Problems related to Data Clustering, Multi-criteria Decision Making, Video Analysis, etc. Mathematical tools of Soft Computing.

Recommended Textbooks:

1. Neural Network, Fuzzy Logic and Genetic Algorithms-Synthesis and Applications, S. Rajasekaran and G.A. Vijaya lakshmi Pai (2005), Prentice Hall.
2. Introduction to Data Mining And Soft Computing Techniques, M. Ramakrishna Murthy (2016), Laxmi Publications Private Limited.
3. Learning and Soft Computing, V. Kecman (2004), Pearson Education.
4. Materials Design Using Computational Intelligence Techniques, Shubhabrata Datta (2016), CRC Press.
5. Genetic Algorithms in Engineering and Computer Science, G. Winter, J. Periaux and M. Galan (1995), John Wiley & Son Ltd.
6. Pattern Recognition and Machine Learning, Christopher Bishop (2006), Springer.
7. Deep Learning, Ian Good fellow, Yoshua Bengio and Aaron Courville (2016), MIT Press,

http://www.deeplearningbook.org
Web References: 1. "SWAYAM: Introduction to Machine Learning", https://swayam.gov.in/courses/4733-july-2018-introduction-to-machine-learning. 2. "NPTEL: Deep Learning", https://onlinecourses.nptel.ac.in/noc18_cs41/ 3. "SWAYAM: Artificial Intelligence", https://swayam.gov.in/courses/5011-artificial-intelligence. 4. "NPTEL: Introduction to Soft Computing", https://onlinecourses.nptel.ac.in/noc18cs13/preview **5.** "NPTEL: Introduction to Artificial Neural Networks", https://nptel.ac.in/courses/ 117105084/

Course Title	PAPER–III: MACHINE LEARNING (Elective) PHDCS-103(IV)
Discipline Specific	Detail Syllabus

Sessional Test: 30

Final Exam: 70

UNIT-I

Introduction to machine learning and different types of learning: Overview of Machine Learning; Definition, Components of a learning problem, Applications, Choosing a Model Representation, Types of learning: Supervised Learning, Unsupervised Learning, Semi-supervised learning, Reinforcement Learning, Inductive Learning or Prediction,

UNIT-II

Linear Regression and Decision Trees, Instance based learning and Feature Selection: Regression, Types of Regression Models, LMS Algorithm, Decision Tree, Overfitting, InstanceBased Learning, Basic k-nearest neighbor classification, KNN, Euclidean Distance, Feature Reduction in ML, Subset selection, Feature extraction, PCA

UNIT-III

Probability and Bayes Learning, Support Vector Machines, Clustering: Probability for Learning, Bayes Theorem, MAP Learner, Naïve Bayes, Bayesian Network, Logistic Regression for classification, Support Vector Machines, Unsupervised learning, Partitioning Algorithms, Hierarchical Clustering, Density based Clustering, K-means algorithm.

UNIT-IV

Neural Network: Neuron, ANNs, Perceptrons, Gradient Descent, Back propagation, Deep Learning, Deep Neural Network, Hierarchical Representation, Unsupervised Pre-training, Activation Functions

Recommended Textbooks

1. Alpaydin E, “Machine Learning”, MIT Press, 2014.
2. Bishop C, “Pattern Recognition and Machine Learning”, Springer, 2006.
3. Duda R, Hart E and Stork D, “Pattern Classification”, Wiley-Inter science, 2000.
4. Mitchell T, “Machine Learning”, Mc Graw-Hill, 2017.
5. Hastie T, Tibshirani R and Friedman J, “Elements of Statistical Learning”, Springer, 2017.

Course Title	PAPER-III: Internet of Things (Elective) PHDCS-103 (V)
Discipline Specific	Detail Syllabus

Sessional Test: 30

Final Exam: 70

UNIT-I

Introduction – Concepts behind the Internet of Things IoT definition, advantages, and impact, essential components of IoT (Introduction of IoT devices and discussion on the difference among IoT devices, computers, and embedded devices). The IoT paradigm: Smart objects sensors and actuators in IoT (accelerometer, photo resistor, buttons, motor, LED, vibrator, analog signal vs. digital signal), Bits and atoms, Goal orientation.

UNIT-II

Technologies behind the Internet of Things Convergence of technologies. RFID + NFC, Wireless networks + WSN, RTLS + GPS, Agents + Multi agent systems. IoT architecture, component and technology (Device, networking, cloud computing and big data analysis). IoT challenges (computation and communication constraints, power constraints, maintenance cost, reliability, data trustworthiness, security, and privacy).

UNIT-III

Security and Privacy for Internet of Things Definitions, notions, relations, needs, threats, requirements; Privacy Enhancing Technologies (PET), etc. discussion on security threats on specific IoT applications (unauthorized access, side-channel attacks, safety ricks); cyber security overview in IoT, data privacy in IoT: introduction to privacy enhancing techniques including keyword search and differential privacy, device/user authentication in IoT: introduction to authentication techniques including password, biometric, proximity-based, and behavior based techniques, data trustworthiness problem in IoT and some mechanisms to enhance data trustworthiness.

UNIT-IV

Literature Review
A review of Internet of Things, a review on technologies behind the internet of Things, a survey on IoT devices, IOT applications, Security threats and techniques in IoT, survey on IOT security and privacy challenges, appropriate security/privacy solutions for IoT, Review on IoT Security Models and Frameworks.

Text Books and References:

1. Books, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, by Francis da Costa, ISBN: 978-1-4302-5740-0, 2013.
2. Security and the IoT ecosystem, KPMG International, 2015.
3. Architecting the Internet of Things, by Dieter Uckelmann, Mark Harrison and Florian Michahelles, ISBN: 978-3-642-19157-2, 2011.
4. Internet of Things: Privacy & Security in a Connected World" by Federal Trade Commission, 2015.
5. Internet of Things: IoT Governance, Privacy and Security Issues" by European Research Cluster, 2015.

6. Internet of Things – Global Technological and Society Trends – Smart Environments and spaces to Green ICT; Ed. Ovidiu Vermesan, SINTEF, NO & Peter Friess, EU, BE; The River Publishers Series in Communications; ISBN: 978-87-92329-67-7.
7. Internet of Things – Legal Perspectives; Rolf H. Weber and Romana Weber; Forlag
8. "The Internet of Things", Proceedings of the 20th Tyrrhenian Workshop on Digital Communication Ed. Daniel Giusto, Antonio lera, Giacomo Morabito and luigiatzori; Springer, 2010.

Course Title	Paper IV: Research and publication ethics CPE-RPE – 104
Core Theory	Detail Syllabus

Internal: 20

External: 30

RESEARCH AND PUBLICATION ETHICS

OBJECTIVE: This course has total 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, Impact Factor, etc.) and plagiarism tools will be introduced in this course.

COURSE CONTENTS:

1. Pedagogy: Classroom teaching, guest lectures, group discussions, and practical sessions.
2. Evaluation: Continuous assessment will be done through tutorials, assignments, quizzes, and group discussions. Weightage will be given for active participation. Final written examination will be conducted at the end of the course.
3. Course structure: The course comprises of six modules listed in table below. Each module has 4-5 units.

MODULES	UNIT TITLE	TEACHING HOURS
Theory		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
Practice		
RPE 04	Open Access Publishing	4
RPE 05	Publication Misconduct	4
RPE 06	Databases and Research Metrics	7

Total: - 30

SYLLABUS IN DETAIL

THEORY

RPE 01: PHILOSOPHY AND ETHICS (3 hrs.)

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgments and reactions

RPE 02: SCIENTIFICCONDUCT (5 hrs.)

1. Ethics with respect to science and research

2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

RPE 03: PUBLICATION ETHICS (7 hrs.)

1. Publication ethics: definition, introduction and importance
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
5. Violation of publication ethics, authorship and contributor ship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

PRACTICE
RPE 04: OPEN ACCESS PUBLISHING (4 hrs.)

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

RPE 05: PUBLICATION MISCONDUCT (4hrs.)

(A) Group Discussions (2 hrs.)
   1. Subject specific ethical issues, FFP, authorship
   2. Conflicts of interest
   3. Complaints and appeals: examples and fraud from India and abroad

(B) Software tools (2 hrs.): Use of plagiarism software like Turnitin, Urkund and other open-source software tools

RPE 06: DATABASES AND RESEARCH METRICS (7hrs.)

(A) Databases (4 hrs.)
   1. Indexing databases
   2. Citation databases: Web of Science, Scopus, etc.

(B) Research Metrics (3 hrs.)
   1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score Metrics: h-index, g index, i10 index, altmetrics

Course Detail	**Seminar/Presentation** **PHDCS-105**
Discipline Specific	**Detail Syllabus**
Seminar/Presentation: 50 This course will be handled by the Guide/Supervisor of the respective student. Concerned guide will assign topics for review writing other than the topic of Ph.D. Student and the students will have to submit the review to HOD/Dean/Director of the Research Center which will be assessed by an expert. This will be followed by presentation and will be assessed by group of teachers.	