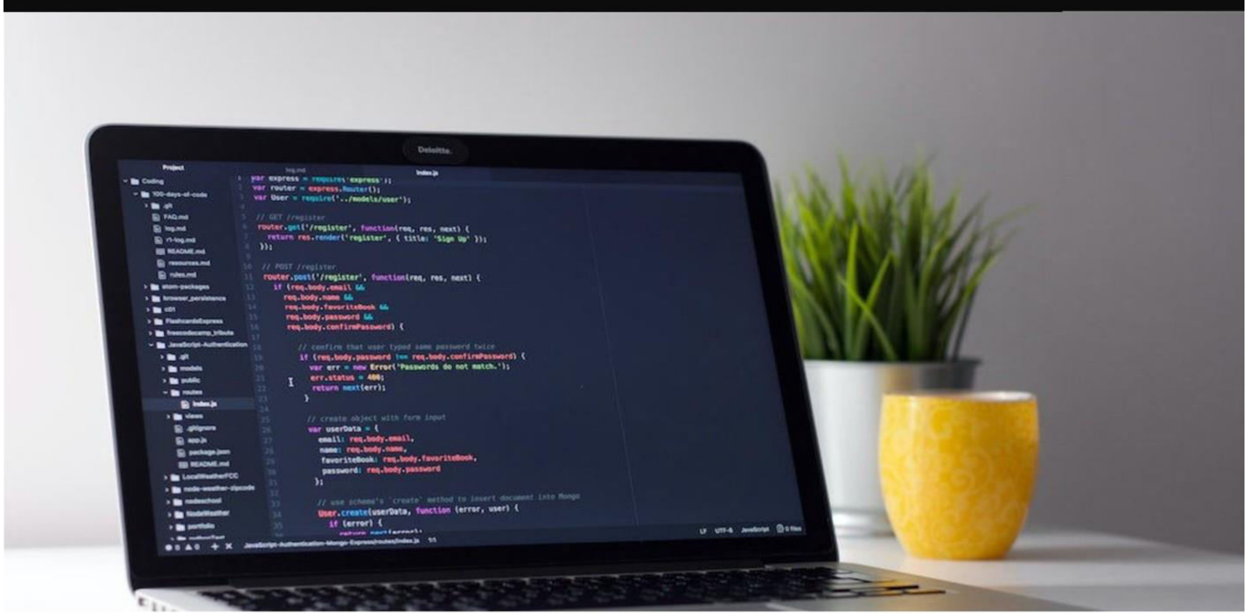
School of Computer Science & Applications

ACADEMIC HAND BOOK



Ordinance & AcademicRegulations
Bachelor of Computer Application (BCA)

Index

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 LOCFinculcation 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

IntheseRegulations,unlessthecontextotherwiserequires:

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”meansatheoryorpracticalsubjectsthatarenormallystudiedinasemester.
4. “VC,Vice-*Chancellor*ofIIMT-University”meanstheHeadoftheUniversity.
5. “Registrar”istheHeadofallAcademic andGeneralAdministrationoftheUniversity.
6. “Dean” means the authority of the school who is responsible for all academic activities of variousprogrammes and implementation of relevant rules of these Regulations pertaining to the AcademicProgrammes.
7. “COE, Controller of Examinations” means the authority of the University who is responsible for allactivities relate dotheUniversityExaminations,publicationofresults,awardofgradesheetsanddegrees.

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"meansDepartmentExamCommittee.
13. "BoS"meansBoardofStudies.
14. "ACM" means Academic Council Meeting the highest authoritative body for approval for allAcademicPolicies.
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 thesemester.
17. "ESE" is End Semester Examination conducted by the University at the End of the Semester for allthecoursesofthatsemester.
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 EducationInstitutions.
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: Thegraduates'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:

- Demonstratecapability 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 ApplicationProgramme 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 projectreports.

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. ASSESMENT 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 – ASSESMENT 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 amaximum of two semesters for reasons of ill health, start – up venture or other valid reasons asrecommendedbyacommitteeconsistingofHeadofDepartment,DeanofSchool,andDean(StudentWelfare).

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. 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/ACEDIMIC 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 thecampus and not to indulge in any activity which may affect adversely the prestige reputation of theUniversity and School.

27. STUDENT WELFARE

Any act of indiscipline of a student reported to the Dean (Students Welfare) and Head of theDepartment will be referred to a Discipline Committee constituted for the purpose. The Committeewill 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-Chancellorfor the implementation of the decision. The student concerned may appeal to the Vice-Chancellor,whosedecisionwillbethefinal.

28. RAGGING

Ragging in any form is a criminal and non-bailable offence in our country. The current State andCentrallegisolationsprovidestringentpunishmentsincludingimprisonment.Oncetheinvolvementofastudent(s) is established in ragging, offending fellow students/staff, harassment of any nature to thefellow students/staff etc. the student(s) will be liable to be dismissed from the University, as per thelaid down procedures of the UGC / Govt. /Institute. Every senior student at the University, along withtheir parent, shall give an undertaking every year in this regard and the same should be submitted at the timeofRegistration.

29. POWER TO MODIFY

Notwithstandingallthathasbeenstatedabove,theAcademicCouncilisvestedwithpowerstomodifyany or all the above regulations from time to time, if required, subject to the approval by the Board ofStudiesand finalapprovalbyVice-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) Semester - I										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCA-NEP-101	Problem Solving using C	C1	4	0	0	25	75	**100**	**4**
2	BCA-NEP-102	Fundamentals of Computer and IT	C2	4	0	0	25	75	**100**	**4**
3	BCA-NEP-104	1. Mathematics-I 2. Discrete Mathematics	DSE	4	0	0	25	75	**100**	**4**
4	NHU-111	English Communication	AECC	3	0	0	15	35	**50**	**3**
5	BCA-NEP-105P	Problem Solving using C	CORE LAB 1	0	0	4	25	25	**50**	**2**
6	BCA-NEP-106P	Fundamentals of Computer and IT Lab	CORE LAB 2	0	0	4	25	25	**50**	**2**
		Grand Total		**15**	**0**	**8**	**140**	**310**	**450**	**19**

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: STUDENT CAN TAKE NCC (GENCC-101) AS A GENERAL ELECTIVE/OPTIONAL COURSE AND CERTIFICATE WILL BE PROVIDED AFTER COMPLETION OF NCC COURSE.

Bachelors in Computer Application (BCA) Semester - II										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCA-NEP-201	Data Structure and Algorithms using C	C1	4	0	0	25	75	**100**	**4**
2	BCA-NEP-202	Database Management System	C2	4	0	0	25	75	**100**	**4**
3	BCA-NEP-204	1. Mathematics-II 2. Optimization Techniques	DSE	4	0	0	25	75	**100**	**4**
4	*Code will be decided by parent department	GE-I(To be opted by the students as per the given electives in the list attached)	GE (Mandatory)	4	0	0	25	75	**100**	**4**
5	NHU-112	Environmental & Ecology	AECC	3	0	0	15	25	**50**	**3**
6	BCA-NEP-205P	Data Structure and Algorithms using C	CORE LAB 1	0	0	4	25	25	**50**	**2**
7	BCA-NEP-206P	Database Management System Lab	CORE LAB 2	0	0	4	25	25	**50**	**2**
8	BCA-NEP-207P	MOOCS/NPTEL	SEC	4	0	0	50	0	**50**	**4**
		Grand Total		**23**	**0**	**8**	**215**	**375**	**600**	**27**
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										

Bachelors in Computer Application (BCA) Semester - III										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCA-NEP-301	OOPS using JAVA	C1	4	0	0	25	75	**100**	**4**
2	BCA-NEP-302	Operating System	C2	4	0	0	25	75	**100**	**4**
3	BCA-NEP-304	1. Computer System Architecture 2. Data Analytics	DSE	4	0	0	25	75	**100**	**4**
4	BCA-NEP-303	Communication Skill & Personality Development	AECC	3	0	0	15	35	**50**	**3**
5	BCA-NEP-305P	OOPS using JAVA Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
6	BCA-NEP-306P	Operating System Lab	CORE LAB 2	0	0	4	25	25	**50**	**2**
		Grand Total		**15**	**0**	**8**	**140**	**310**	**450**	**19**
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: STUDENT CAN TAKE NCC (GENCC-101) AS A GENERAL ELECTIVE/OPTIONAL COURSE AND CERTIFICATE WILL BE PROVIDED AFTER COMPLETION OF NCC COURSE.										

Bachelors in Computer Application (BCA) Semester - IV										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCA-NEP-401	Software Engineering	C1	4	0	0	25	75	**100**	**4**
2	BCA-NEP-402	Python Programming	C2	4	0	0	25	75	**100**	**4**
3	BCA-NEP-404	1. Data Mining 2. Numerical Analysis	DSE	4	0	0	25	75	**100**	**4**
4	*Code will be decided by parent department	GE-II (To be opted by the students as per the given electives in the list attached)	GE (Mandatory)	4	0	0	25	75	**100**	**4**
5	UVE-401	Human Values and Professional Ethics	AECC	3	0	0	15	35	**50**	**3**
6	BCA-NEP-405P	Software Engineering Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
7	BCA-NEP-406P	Python Programming Lab	CORE LAB 2	0	0	4	25	25	**50**	**2**
8	BCA-NEP-407P	MOOCS/NPTEL	SEC	4	0	0	50	0	**50**	**4**
		Grand Total		**23**	**0**	**8**	**215**	**385**	**600**	**27**
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										

Bachelors in Computer Application (BCA) 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)
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

IIMTU-NEP IMPLEMENTATION
CBCS: Statement of Credit Distribution

College/School: SCHOOL OF COMPUTER SCINECE AND APPLICATIONS Programme: BCA Duration: 3 YEARS Annual/Semester : SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee)

Minimum Credit Score Required For Certificate (40)	First Year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP) /Industrial Internship /Industrial Project	Prerequisite
CERTIFICATE	First Year Credit 46	I	Problem Solving using C (Th. 4 Cr. + P 2Cr.) Fundamentals of Computers and IT (Th. 4 Cr. + P 2Cr.)	English communication (Th. 3 Cr.)		1.Mathematics I 2. Discrete Mathematics (Th. 4 Cr.)			
		II	Data Structure Algorithms using C (Th. 4 Cr. + P 2Cr.) DBMS (Th. 4 Cr. + P 2Cr.)	Environment & Ecology (Th. 3 Cr.)	MOOCS/NPTEL 4 Cr.	1. Mathematics II 2. Optimization Techniques (Th. 4 Cr.)	GE-I (Mandatory) (Th. 4 Cr.)		Problem Solving using C Mathematics I

Note: - Students can take NCC (GENCC-101) as a general elective/optional course and certificate will be provided after competition of NCC Course.

College/School: SCHOOL OF COMPUTER SCINECE AND APPLICATIONSProgramme: BCA Duration: 3 YEARS Annual/Semester - SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee) Provision to change the stream onwards

Minimum Credit Score Required for Diploma (80)	Second Year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP) /Industrial Internship /Industrial Project	Prerequisite
DIPLOMA	Second Year Credit 46	III	OOPS using JAVA (Th. 4 Cr. + P 2 Cr.) OPERATING SYSTEM (Th. 4 Cr. + P 2Cr.)	Communication Skill & Personality Development (Th. 3 Cr.)		1. Computer System Architecture 2. Data Analytics (Th. 4 Cr.)			
		IV	Software Engineering (Th. 4 Cr. + P 2Cr.) Python Programming (Th. 4 Cr. + P 2Cr.)	Human Values and Professional Ethics (Th. 3 Cr.)	MOOCS/NPTEL 4 Cr.	1. Data Mining 2. Numerical Analysis (Th. 4 Cr.)	GE-II (Mandatory) (Th. 4 Cr.)		

Note: - Students can take NCC (GENCC-101) as a general elective/optional course and certificate will be provided after competition of NCC Course.

College/School: SCHOOL OF COMPUTER SCINECE AND APPLICATIONSProgramme: BCA Duration: 3 YEARS Annual/Semester - SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee) Provision to change the Core Papers (Main Subject)

Minimum Credit Score Required for Degree (120)	Third Year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP) /Industrial Internship /Industrial Project	Prerequisite
DEGREE	Third Year Credit 50	V	Design and Analysis of Algorithms (Th. 4 Cr. + P 2Cr.) Web Technologies (Th. 4 Cr. + P 2Cr.)		.	1. Data Communication Network 2. ERP 3. BIG Data (Th. 4Cr.)		RP-1 (AUDIT) Non-Credit (Research Project-I) Internship (Mandatory) (5 Cr.)	Data Structure Algorithms using C
		VI	Cyber Security (Th. 4 Cr. + P 2Cr.) Artificial Intelligence (Th. 4 Cr. + P 2Cr.)		MOOCS/NPTEL 4 Cr.	1. Mobile Computing 2. E-Commerce 3. Real Time System (Th. 4 Cr.)	GE-III (Mandatory) (Th. 4 Cr.)	RP-II (AUDIT) Non-Credit (Research Project-II) Industrial Project (5 Cr.)	

Format-2

Format-2

IIMTU-NEP Implementation: BCA

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 (46 Cr.)**	**SEMESTER -I (19 Cr.)**	i) C1 (Th. 4 Cr. + P 2 Cr.) ii) AECC-I iii) DSE-I	4 2 3 4	4 4 3 4	45 10 40 45	Problem Solving using C Problem Solving using C lab English Communication 1. Mathematics-I 2. Discrete Mathematics	5 5 5		
			ii) C2(Th.4 Cr.+P 2 Cr)	4 2	4 4	45 10	Fundamentals of Computers & ITFundamentals of Computers & IT Lab	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 – II (27 Cr.)	i) C3 (Th. 4 Cr. + P 2 Cr.) ii) AECC-II iii) SEC-I & II iv) DSE-II v) GE-I	4 2 3 4 4 4	4 4 3 8 4 4	45 10 40 40 45 45	Data Structure Algorithms using C Data Structure Algorithms using C LabEnvironment &Ecology MOOCS (NPTEL) 1. Mathematics-II 2. Optimization Techniques #To be selected from other School	5 5 5 5 5		
			ii) C4 (Th.4Cr.+ P 2 Cr.)	4 2	4 4	45 10	Database Management System Database Management System Lab	5		

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

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.

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.

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.

***Program Outcome and Program Specific Outcome – See Annexure – 1**

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 (46 Cr.)**	**SEMESTER –III (19 Cr.)**	i) C5 (Th. 4 Cr. + P 2 Cr.) ii) AECC-III iii) DSE-III	4 2 3 4	4 4 3 4	45 10 40 45	OOPS using Java OOPS using Java Lab Communication Skill & Personality Development 1. Computer System Architecture 2. Data Analytics	5 5 5		
			i) C6 (Th. 4 Cr. + P 2 Cr.)	4 2	4 4	45 10	Operating System Operating System Lab	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 (27 Cr.)	i) C7 (Th. 4 Cr. + P 2 Cr.) ii) AECC-IV iii) SEC-III & IV iv) DSE-IV v) GE-II	4 2 3 4 4 4	4 4 3 4 4 4	45 10 40 40 45 45	Software Engineering Software Engineering Lab Human values and Professional Ethics MOOCS (NPTEL) 1. Data Mining 2. Numerical Analysis #To be opted from other School	5 5 5 5 5		
			ii) C8 (Th. 4 Cr. + P 2 Cr.)	4 2	4 4	45 10	Python Programming Python Programming Lab	5		

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.

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 (50 Cr.)	SEMESTER –V (21 Cr.)	i) C9 (Th. 4 Cr. +	4	4	45	Design and Analysis of Algorithm	5		
			P 2 Cr.)	2	4	10	Design and Analysis of Algorithm Lab			
			ii) DSE-V	4	4	45	1. Data Communication Network 2. ERP 3. BIG Data	5		
			ii) C10 (Th. 4 Cr. +P	4	4	45	Web Technologies	5		
			2 Cr.)	2	4	10	Web Technologies Lab			
			iii) Research Project	NC						
			iv) Internship (Mandatory)	5	5	10	Internship			
		SEMESTER –VI (29 Cr.)	i) C11 (Th. 4 Cr. +	4	4	45	Cyber Security	5		
			P 2 Cr.)	2	4	10	Cyber Security Lab			
			ii) SEC-V & VI	4	4	40	MOOCS (NPTEL)	5		
			iii) DSE-VI	4	4	45	1.Mobile Computing 2. E-Commence 3. Real Time System	5		
			iv) GE-III	4	4	45	#To be opted from other School	5		
			ii) C12 (Th. 4 Cr. +	4	4	45	Artificial Intelligence	5		
			P 2Cr.)	2	4	10	Artificial Intelligence Lab			
			iii) Research Project	NC						
			iv) Industrial Project (Mandatory)	5	5	10	Industrial Project			

Format-3

Format-3

IIMTU-NEPIMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class: BCA**	Year: I Semester: I
Credits Theory: 3 Cr	**Subject: English communication**
Course Code: NHU-111	**Title: English Communication**

Course Objectives:
CO1: It aims to improve English communication skills i.e., Listening, speaking, reading, & writing.
CO2: To develop potential skills to deal confidently in English with diverse situations in the external world.
CO3: To work in a collaborative manner & communicate effectively in English.
CO4: To get exposure to various activities related to English Communication which will enable the learners to take initiative, solve problems, and demonstrate a positive work ethics.

Nature of Paper: AECC

Minimum Passing Marks/Credits: 40% Marks

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	English Communication skills: listening skills, speaking skills, reading skills, writing skills. Starting and sustaining a conversation. Process of Communication, Essential of effective Communication, Barriers to Communication, Role of Communication	8
II	Public Speech, Delivering skills, Group discussion, Communication in seminars, Conferences and Committees Parts of Speech- Noun, Pronoun, Adjective, Verb, Adverb, Conjunction, Preposition, Interjection, Articles, Common errors in English	8
III	Presentation: Features, Styles, Use of visual aids, Creating a Dynamic Presentation, Presentation and interaction, Telephonic conversation & Basic Etiquette. Non-Verbal Communication: Meaning, Types and Importance. Listening: Difference between Listening and Hearing	8
IV	Word Skills-Synonyms, Antonyms, Words often Confused, Idioms, Phrases, Phrasal Verbs	8
V	Drafting of Notices, Agendas, Minutes, Job Application letter, CV, Business Correspondence, Essentials of Effective Business Correspondence, Types and Structure of Business Letter.	8

Text Books:

- English Grammar and Composition by Wren & Martin
- Effective Communication and Soft Skills by Nitin Bhatnagar
- The ACE of Soft Skills: Attitude, Communication and Etiquette for Success by Gopalaswamy Ramesh and Mahadevan Ramesh

Reference

- English Grammar in Use by Raymond Murphy
- English **Grammar Composition and Usage by J.C. Nesfield**

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination 2) Presentations /Seminar/Attendance 3) Assignments/TA	15
4) Research Project Report Seminar On Research Project Report	Nil
5) ESE	35
Total:	50

Prerequisites for the course: NIL

Course Learning Outcome

CO1: To get knowledge about communication skills.
CO2: To understand about use of grammar.
CO3: To understand about presentation.
CO4: To get information about how to face interview and public.
CO5: To get knowledge about telephonic conversation & etiquette.

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class: BCA**		**Year: I** **Semester: I**
Credits Theory:4Cr	**Subject:** Mathematics-I	
Course Code: BCA-NEP-104	**Title:** Mathematics-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, Methods of Integration Substitution.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks

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, Definite Integral, Simple Problems of Line Integral.	8

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	
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
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, 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-NEPIMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class: BCA**		**Year: I** **Semester: I**
Credits Theory:4Cr	**Subject:** Discrete Mathematics	
Course Code: BCA-NEP-104	**Title:** Discrete Mathematics	

Course Objectives:

CO1: Identify and prove properties of Algebraic Structures like Groups, Rings and Fields. Formulate and solve recurrences and recursive functions.
CO2: Apply the concept of combinatorics to solve basic problems in discrete mathematics.
CO3: Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions.
CO4: Apply mathematical arguments using logical connectives and quantifiers to check the
CO5: Validity of an argument through truth tables and propositional and predicate logic.

Nature of Paper: Discipline Specific Elective

Minimum Passing Marks/Credits: 40% Marks

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	**Set Theory:** Introduction, Size of sets and Cardinals, Venn diagrams, Combination of sets, Multi sets, ordered pairs and Set Identities. **Functions:** Definition, Types of functions, Operations on functions, recursively defined functions. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation.	8
II	**Posets, Hasse Diagram and Lattices:** Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction on flattices, 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	**Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic. **Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection.	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 groups, Homomorphism and Isomorphism of groups. **Rings and Fields:** Definition and elementary properties of Rings and Fields.	8

V	**Natural Numbers:** Introduction, Piano's axioms, Mathematical Induction, Strong Induction and Induction with Nonzero 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 Pigeonhole principle, Polya's Counting theorem.	8

Text Book:
1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill, 2006.
2. B. Kolman, R.C. Bus by and S. Cross", Discrete Mathematics Structures", Prentice Hall, 2004.

Reference Book:
1. R.P. Girimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley, 2004.
2. Y.N. Singh, "Discrete Mathematical Structures", Wiley-India, First edition,2010.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 identify the properties of functions and relations.
CO2: 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.

IIMTU-NEP IMPLEMENTATION
Year - I/ Semester- I

Programme:UG **Class:BCA**	Year: I Semester:I
Credits Theory: 0 Practical: 2	**Subject:Fundamental of Computer and IT LAB**
Course Code: BCA-NEP-106P	**Title:Fundamental of Computer and IT LAB**

Course Objectives:
CO1: Understand Computer Fundamentals – hardware and Software
CO2: Understand computer networks
CO3: Study Office automation tools
CO4: Email and search engines

Nature of Paper: Core

Minimum Passing Marks/Credits:50% Marks

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	Identify the internal and external hardware/peripheral components	2
II	Identify the internal and external hardware/peripheral components	2
III	Prepare and print Bio-data with a covering letter using word processor.	2
IV	Calculation of Total mark, grade based on boundary conditions for n number of students using Spread sheet.	2
V	Preparation of presentation (with transition and animations, insertion of scanned images and internet contents)	2
VI	Email id creation, sending and receiving of email with attachments.	2
VII	Demonstrate how to create email-id and uploading and downloading files.	2
VIII	Identify various operating system file management commands (create, copy, move, delete and rename folders and files)	2

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	25 25
Total:	50

CourseLearning Outcomes: Student will be able to:
CO1: Converse in basic computer terminology
CO2: Formulate opinions about the impact of computers on society
CO3: Possess the knowledge of basic hardware peripherals

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class: BCA**	**Year: I** **Semester: I**
Credits Theory:4Cr	**Subject:** Mathematics-I
Course Code: BCA-NEP-104	**Title:** Mathematics-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, Methods of Integration Substitution.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks

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, Definite Integral, Simple Problems of Line Integral.	8

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

1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
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, 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.

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class:BCA**		Year: I Semester: I
Credits Theory:4Cr	**Subject:**Fundamentals of Computers and IT	
Course Code: BCA-NEP-102	**Title:** Fundamentals of Computers and IT	
Course Objectives: 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.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 40% Marks		
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 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, HD, Pen drive), Input and Output Devices.	8
II	**Number Systems:** Introduction to Binary, Octal, Decimal, Hexadecimal Number Systems, Conversion, Simple Addition, Subtraction, Multiplication and division. **Algorithm and Flowcharts:** Definition, Characteristics, Advantages and Disadvantages, Symbols of Flow Chart.	8
III	**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, Batch Files. Windows - History, Icons, Files and Folders, Control Panel, Task Bar, Desktop.	8
IV	**Office Tools:** Basic Concepts, Uses. **Word:** Menu Bar, Menus, Submenus, Tool Bar, Tools, Customizing Toolbar, Hiding Toolbar, Creating and Saving Documents, Working with an Existing Document, Auto Text, Auto Complete and Auto Correct; Formatting a Document, Word Art, Using Tables and Columns-Table Creation and Modification Giving Stress to Auto-Fit, Auto-Format; Object Linking and Embedding, Inserting and Sizing Graphics, Hyperlink, Envelopes & Label Creation, Grammar & Spell Check, Previewing and Printing Documents, Mail Merge.	8

	Excel: Creating a Simple Spreadsheet, Editing a Spreadsheet, Working with Functions and Formula, Formatting Worksheets, Creating Charts, Inserting and Formatting Data in a Worksheet, Working with an Existing Data List, Auto Fill, Fill Series and Auto- complete Options, Formatting Cells; Sorting & Filtering Data, Conditional Formatting, Interlinking Worksheets and Files, Setting Filters and Performing Calculations on Filtered Data etc.	
V	**Power Point:**Creating and Viewing Presentations, Editing a Presentation, Editing Master Slides, Inserting, Sorting, Hiding and Deleting Slides, Inserting Pictures, Creating Tables, Slide Layouts, Adding Transition and Animation Effect, Hyper Linking Slides & Files. **Internet and its Applications:** Introduction, Usage, Browser, Websites, Protocol, Domain Name, IP address,E-Mail, TELNET, FTP, World Wide Web, Portal, Blogging, E-Learning and wiki, Social Networking	8

Text Books:

1. P.K. Sinha, "*Fundamental of Computers",*BPB Publications.
2. Stephen W. Sagman & Gail Taylor, *"MS-Office 2000For Windows*", Peachpit Press.

Reference

1. V.Rajaraman, "*Fundamental of Computers*", Prentice-Hall of India.

Evaluation/Assessment Methodology

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

Prerequisites for the course:NIL

Course Learning Outcomes:

CO 1: Demonstrate the use of mathematical software and solve simple mathematical problems.
CO 2: Explain the needs of hardware and software required for a computation task.
CO 3: State typical provisions of cyber law that govern the proper usage of Internet and computing resources.
CO 4: Explain the working of important application software and their use to perform any engineering activity.
CO 5: Demonstrate the use of Operating system commands and shell script.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Program: UG **Class: BCA**	Year: I Semester: I
Credits: Practical: 2	**Subject: Problem-Solving using C Lab**
Course Code: **BCA-NEP-105P**	**Title: Problem-Solving using C Lab**

Course Objectives:

CO 1: 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

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.)	
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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	25
5) ESE	25
Total:	50

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

IIMTU-NEP IMPLEMENTATION
Year- I / Semester – I

Programme: Certificate **Class: BCA**		Year: I Semester: I
Credits Theory:4Cr Practical:2Cr	**Subject: Problem Solving using C**	
Course Code: BCA-NEP-101	**Title: Problem Solving using C**	

Course Objectives:

CO 1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.
CO 2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements.
CO 3: Students will be familiar with concept of Arrays, Pointers, Functions, categories of function and recursion.
CO 4: Students will be able to develop Program with Structure; learn Union and Complete String Operations.
CO 5: Students will be familiar with File handling programs to perform read write operations.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks

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	**Introduction to ‘C’ Language:** History, C Character Set, Tokens, Keywords, Constants, Identifiers, Variables, Data Types, Comments, Structures of ‘C’ Program, Introduction to Pre-processor Directives: #include, #define, printf(), scanf(), Declaration, Assignment, Operators, Expressions, Statements, Arithmetic Expressions.	10
II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, Ternary Operator, goto Statement, Loops (for, while, do-while) in C, break and continue Statements, Nested Loops.	10
III	**Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data from Array, Using Arrays with Functions, Multi-Dimensional Arrays. **Pointers:** Basics, Pointer and Function, Array of Pointers. **Storage Classes:** Automatic, External, Static & Register. **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.	9
IV	**String:** Declaring, Initializing, String Manipulation Functions, String Input and Output Functions, String Pointer, Array of Strings, Passing String to Function.	8

	Structure and Union: Basic of Structures, Structures and Functions, Array of Structures, Pointer to Structure, Union.	
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(), ftell(), feof( ) etc.	8

Text Books:

1. E. Balaguruswamy, "*Programming in ANSI C",* Tata Mc.Graw-Hill education.
2. YashwantKanetkar, *"Let us C"*, BPB Publications

Reference

1. V Rajaraman, "*Computer Basics and C Programming*", PHI Learning
2. Ashok N. Kamthane, "*Programming in C*", Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 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

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

Programme: Certificate **Class:BCA**		**Year: I** **Semester:** II
Credits Theory:4Cr	**Subject:**Optimization Techniques	
Course Code: BCA-NEP-204	**Title:**Optimization Techniques	

Course Objectives:

CO1: Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.

CO2: Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function).

CO3: The problem formulation by using linear, dynamic programming, game theory and queuing models.

CO4: The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.

CO5: Formulation of mathematical models for quantitative analysis of managerial problems in industry.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks

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

Unit	Contents	No. of Lectures Allotted
I	**LINEAR PROGRAMMING (L.P):** Revised Simplex Method, Duel simplex Method, Sensitivity Analysis **DYNAMIC PROGRAMMING (D.P):**Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.	8
II	**CLASSICAL OPTIMIZATION TECHNIQUES:** Single variable optimization without constraints,ulti variable optimization without constraints, multivariable optimization with constraints –method of Lagrange multipliers, Kuhn-Tucker conditions. **NUMERICAL METHODS FOR OPTIMIZATION:** Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method,Newton's method.	8
III	**MODERN METHODS OF OPTIMIZATION:** **GENETIC ALGORITHM (GA):** Differences and similarities between conventional and evolutionary algorithms, working principle, Genetic Operators- reproduction, crossover, mutation **GENETIC PROGRAMMING (GP):** Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, Random population generation. Fuzzy Systems: Fuzzy set Theory, Optimization of Fuzzy systems	8

IV	**QUEUING THEORY** Queuing Model, poison and exponential distributions -Queues with combined arrivals and departures-random and series queues.	8
V	**INTEGER PROGRAMMING:** Graphical Representation, Gomory's Cutting Plane Method, Balas' Algorithm for Zero–One Programming, Branch-and-Bound Method. **APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS:** Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.	8

Text Books:

1. J. K. Sharma, "Operations Research", Macmillan, 5th Edition, 2012.
2. R. Pannerselvan, "Operations Research", 2nd Edition, PHI Publications, 2006.

Reference

1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2013.
2. Maurice Saseini, ArhurYaspan, Lawrence Friedman, "Operations Research: Methods & Problems",1st Edition, 1959.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 appropriate optimization method to solve complex problems involved in various industries.

CO2: Demonstrate the optimized material distribution schedule using transportation model to minimize total distribution cost.

CO3: Find the appropriate algorithm for allocation of resources to optimize the process of assignment.

CO4: Apply the knowledge of game theory concepts to articulate real-world competitive situations toidentify strategic decisions to counter the consequences.

CO5: Develop a suitable queuing system to control important performance measures dynamically.

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

<table>
<tr><td colspan="2">Programme: Certificate
Class:BCA</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td>Credits
Theory:4Cr
Practical:2Cr</td><td colspan="3">Subject:Data Structure Algorithms using C</td></tr>
<tr><td>Course Code:
BCA-NEP-201</td><td colspan="3">Title:Data Structure Algorithms using C</td></tr>
<tr><td colspan="4">Course Objectives:</td></tr>
<tr><td colspan="4">CO1: Demonstrate familiarity with major algorithms and data structures.
CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.
CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.
CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.
CO5: Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">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, Deques, Priority Queues, Applications of Queue.</td><td>8</td></tr>
<tr><td>IV</td><td colspan="2">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.</td><td>8</td></tr>
</table>

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

Text Books:
1. 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

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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: Demonstrate familiarity with major algorithms and data structures.

CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.

CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.

CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.

CO5: Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

Programme: Certificate **Class:**BCA		**Year: I** **Semester:** II
Credits Theory:4Cr	**Subject:**DATA BASE MANAGEMENT SYSTEM	
Course Code: BCA-NEP-202	**Title:**DATA BASE MANAGEMENT SYSTEM	

Course Objectives:

CO 1: Explain the concept of features of a database system and its application and compare various types of data models.
CO 2: Describe the E-R Models and Relational Database.
CO 3: Explain the concept of SQL Commands, relational algebra, tuple calculus and domain calculus.
CO 4: Explain the need of normalization and normalize a given relation to the desired normal form.
CO 5: Analyze the different approaches of transaction processing and concurrency control.

Nature of Paper: CORE

Minimum Passing Marks/Credits:40% Marks

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:** 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 Modelling 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 join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design.	8
IV	**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable	8

	Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System	
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. 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 2) Presentations /Seminar 3) Assignments	15
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-NEPIMPLEMENTATION
Year-I / Semester-II

<table>
<tr><td colspan="2">Programme:Certificate
Class:BCA</td><td colspan="2">Year:I
Semester: II</td></tr>
<tr><td colspan="2">Credits
Theory:3Cr</td><td colspan="2">Subject: Environment and Ecology</td></tr>
<tr><td colspan="2">Course Code:
NHU-112</td><td colspan="2">Title:Environment and Ecology</td></tr>
<tr><td colspan="4">CourseObjectives:
CO1: Creating the awareness about environmental problems among people
CO2: Imparting basic knowledge about the environment and its allied problems.
CO3: Developing an attitude of concern for the environment.
CO4: Motivating public to participate in environment protection and environment improvement.
CO5: Grasp the significance and issues related to ecosystems, biodiversity and natural resources.</td></tr>
<tr><td colspan="4">Nature of Paper: AECC</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="4">L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. ofLectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">The Multidisciplinary Nature Of Environmental Studies:
Definition, Scope and Importance, Need for Public Awareness.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">Natural Resources: Renewable And Non-Renewable Resources;
Natural Resources and Associated Problems: -
A. Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies. Timber Extraction, Mining, Dams and Their Effects on Forests and Tribal People.
B. Water Resources: Use and Over-Utilization of Surface and Ground Water, Floods, Drought, Conflicts Over Water, Dams-Benefits and Problems.
C. Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies.
D. Food Resources: World Food Problems, Changes Caused By Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies.
E. Energy Resources: Growing Energy Needs, Renewable and Non renewable Energy Sources, Use of Alternate Energy Sources, Case Studies
F. Land Resources: Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification.
G. Role of an Individual In Conservation Of Natural Resources; Equitable Use of Resources for Sustainable Lifestyles</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">Ecosystems:
Concept of an Ecosystem; Structure and Function of an Ecosystem; Producers, Consumers and Decomposers; Energy Flow in the Ecosystem; Ecological Succession; Food Chains, Food Webs and Ecological Pyramids;</td><td>8</td></tr>
</table>

	Introduction, Types, Characteristic Features, Structure And Function of the Following Ecosystem: - A) Forest Ecosystem B) Grassland Ecosystem C) Desert Ecosystem D) Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries)	
IV	**Biodiversity and Its Conservation:** Introduction – Definition: Genetic, Species and Ecosystem Diversity; Biogeographical Classification of India; Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, and Aesthetic and Option Values; Biodiversity at Global, National and Local Levels; India as a Mega-Diversity Nation; Hot-Sports of Biodiversity; Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts; Endangered and Endemic Species of India; Conservation of Biodiversity: In-Situ and Ex-Situ Conservation of Biodiversity.	8
V	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Pollution; Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes; Role of an Individual in Prevention of Pollution; Pollution Case Studies; Disaster Management: Floods, Earthquake, Cyclone and Landslides.	8

Text Books:

1. A. Basak, "*Environmental Studies",* Pearson Education.
2. Anil Kumar De, "*Environmental Studies*", New Age International

Reference:

1. J. P. Sharma, "*Environmental Studies*", University Science Press.

Evaluation/Assessment Methodology

	Max. Marks 50
1. Class tasks/SessionalExamination 2. Presentations /Seminar 3. Assignments 4. Research Project Report/Seminar On Research Project Report 5. ESE	15 35
Total:	50

Prerequisites for the course:

Course Learning Outcomes:

CO1: Student will be able to recognize the physical and biological components of earth's system.
CO2: Student will be able to examine all environmental issues.
CO3: Student will be able to do independent research on human interaction with the environment.
CO4: Student will be able to develop and attitude of concern for the environment.
CO5: Student will be able to motivate public to participate in environmental protection

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

Programme: Certificate **Class:**BCA		**Year: I** **Semester:** II
Credits Theory: 4Cr	**Subject:**Mathematics-II	
Course Code: BCA-NEP-204	**Title:**Mathematics-II	

Course Objectives:
CO 1: Apply mathematical concepts and principles to perform computations.
CO 2: Apply mathematics to solve problems.
CO 3: Create, use and analyze graphical representations of mathematical relationships.
CO 4: Communicate mathematical knowledge and understanding.
CO 5: Apply technology tools to solve problems.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks

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

Unit	Contents	No. of Lectures Allotted
I	**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
II	**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
III	**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
IV	**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	8
V	**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 heat conduction equations, Laplace equation in two dimension, Equation of transmission lines	8

Text Books:

1. E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & 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.

Reference:

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	
4) Research Project Report	10
Seminar On Research Project Report	
5) ESE	75
Total:	100

Prerequisites for the course: MATHEMATICS-I

Course Learning Outcomes:

CO 1: Apply mathematical concepts and principles to perform computations.
CO 2: Apply mathematics to solve problems.
CO 3: Create, use and analyze graphical representations of mathematical relationships.
CO 4: Communicate mathematical knowledge and understanding.
CO 5: Apply technology tools to solve problems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

Programme:UG **Class:BCA**	Year: I Semester:II
Credits Theory: 0 Practical: 2	**Subject:Data Structure and algorithm using C Lab**
Course Code: **BCA-NEP-205P**	**Title:Data Structure and algorithm using C Lab**

Course Objectives:
CO1: To Understand and Implement basic Data Structure using C
CO2: To apply Linear an Non Linear Data Structure in Problem Solving.
CO3: To Implement Searching and Sorting Algorithm.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks

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	Basic of Data Structure Programs- Looping, Data Manipulation, array.	2
II	Program using Structures and dynamic Memory allocations.	2
III	Array Implementation of Stacks and queues	2
IV	Linked List Implementation of Stacks and Queues	2
V	Application of Stacks and Queues	2
VI	Implementation of Trees, Tree Traversals	2
VII	Implementation of Binary Search Trees	2
VIII	Implementation of Linear search and Binary Search	2
IX	Implementation of Insertion Sort, Bubble Sort, Quick Sort and Merge Sort.	2

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	25 25
Total:	50

CourseLearning Outcomes:
Student will be able to:
CO1: Write basic and advanced Program in C using Linear and Non-Linear Data Structure.
CO2: Implement Data Structure using C.
CO3: Choose appropriate Sorting Algorithm for an application and implement it in a modularized way.
CO4: Linear data structures and their applications such as Stacks, Queues and Lists and Non-Linear Data Structures and their Applications such as Trees.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

<table>
<tr><td colspan="2">Programme:UG
Class: BCA</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td colspan="2">Credits
Theory: 0
Practical: 2</td><td colspan="2">Subject:Data Base Management System Lab</td></tr>
<tr><td colspan="2">Course Code:
BCA-NEP-206P</td><td colspan="2">Title:Data Base Management System Lab</td></tr>
<tr><td colspan="4">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</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 50% Marks</td></tr>
<tr><td colspan="4">L:0
T:0
P:4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">Creation of a database and writing SQL queries to retrieve information from the database.</td><td>2</td></tr>
<tr><td>II</td><td colspan="2">Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.</td><td>2</td></tr>
<tr><td>III</td><td colspan="2">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).</td><td>2</td></tr>
<tr><td>IV</td><td colspan="2">Perform the following:
a. Altering a Table, Dropping/Truncating/Renaming Tables, backing up / restoring a Database.</td><td>2</td></tr>
<tr><td>V</td><td colspan="2">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.</td><td>2</td></tr>
<tr><td>VI</td><td colspan="2">For a given set of relation tables perform the following
a. Creating Views (with and without check option), Dropping views, Selecting from view.</td><td>2</td></tr>
</table>

VII	Write a Pl/SQL program using FOR loop to insert ten rows into a database table.	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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	25
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 Theory:4Cr	**Subject:**Operating System
Course Code: BCA-NEP-302	**Title:**Operating System

Course Objectives:
CO1: To understand the services provided by and the design of an operating system.
CO2: To understand the structure and organization of the file system.
CO3: To understand what a process is and how processes are synchronized and scheduled.
CO4: To understand different approaches to memory management.
CO5: Students should be able to use system calls for managing processes, memory and the file system.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks

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: -** Operating System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview, objectives and functions, Evolution of Operating System, Types of Operating Systems.	12
II	**PROCESSES: -**Process States, Process Description and Process Control Block. Processes and Threads, Types of Threads, Multicore and Multithreading, Scheduling Types of Scheduling, Scheduling algorithms.	12
III	**CONCURRENCY AND SCHEDULING:-** Principles of Concurrency-Mutual Exclusion, Semaphores, Monitors, Readers/Writers problem. Deadlocks-prevention, avoidance, detection, Banker's Algorithm.	12
IV	**MEMORY MANAGEMENT: -** Memory management requirements, Partitioning, Paging and Segmentation, Virtual memory - Hardware and control structures, Page fault, Page replacement algorithms, operating system software, Linux memory management, Windows memory management.	12
V	**INPUT/OUTPUT AND FILE SYSTEMS: -** I/O management and disk scheduling – I/O devices, organization of I/O functions; OS design issues, I/O buffering, disk scheduling, Disk cache. File management – Organization, Directories, File sharing, and Record blocking, secondary storage management.	12

Text Books:
1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley
2. Andrew S. Tanenbaum, "Modern Operating System", PHI Learning
3. Tanenbaum/Woodhaull "Operating System Design and Implementation", Pearson Publication

Reference

1. 4. Harvey M Dietel, “An Introduction to Operating System”, Pearson Education
2. Flynn, “Understanding Operating System”, Cengage.
3. D M Dhamdhere, “Operating Systems : A Concept basedApproach”, McGraw Hill.
4. Charles Crowley, “Operating Systems: A Design-Oriented Approach”, Tata McGraw Hill Education”.

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

Prerequisites for the course: NIL

Course Learning Outcomes:

C01: 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.

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –III

Programme: Diploma **Class:BCA**	**Year: II** **Semester: III**	
Credits Theory:4Cr Practical:2Cr	**Subject:** Communication Skill & Personality Development	
Course Code: BCA-NEP-303	**Title:** Communication Skill & Personality Development	
Course Objectives: CO1: To understand the concept, process and importance of communication. CO2: To develop skills of effective communication both written and oral. CO3: To help acquaint with application of communication skills in the world of business. CO4: To understand the concept of personality and personality development and its significance. CO5: To understand and develop various traits required for personality development.		
Nature of Paper: AECC		
Minimum Passing Marks/Credits: 40% Marks		
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 Communication** Meaning and Definition, Process, Functions, Objectives, Importance, Essentials ofGood Communication, Communication Barriers, Overcoming Communication Barriers.	8
II	**Written Communication:** Need and functions of business letters, Planning and layout of business letters, Advantages and limitations of written communication. **Oral Communication:** Meaning, nature and scope, Principles of Effective Oral Communication, Techniques of Effective Speech, The Art of Listening, Principles of Good Listening, Advantages and Limitations of Oral Communication.	8
III	**Personality Development:** The concept of personality, Dimensions of personality, Term personality development, Significance. **Attitude and Motivation:** Attitude, Concept, Significance, Factors affecting attitudes, Positive attitude, Advantages, Negative attitude, Disadvantages, Ways to develop positive attitude, Difference between Personalities having Positive and Negative Attitude, Concept of motivation, Significance, Internal and external motives, Importance of self-motivation, Factors leading to demotivation.	8
IV	**Self-Esteem:**Term self-esteem, Symptoms, Advantages, Do's and Don'ts to develop positive self-esteem, Low self-esteem, Symptoms, Personality having low self-esteem, Positive and negative self-esteem. **Interpersonal Relationships**: Interpersonal relationships, Teaming, Developing positive personality, Analysis of strengths and weaknesses.	8

V	**Goal-Setting:** Concept of goal-setting, Importance of goals, Dream Vs goal, Why goal-setting fails- SMART (Specific, Measurable, Achievable, Realistic, Time-bound) goals, Art of Prioritisation, Do's and Don'ts about goals. **Essential soft skills Assertiveness -** Lateral thinking - Work ethics, Good manners and etiquettes Concept, significance.	8

Text Books:

1. Cloninger, S.C., "Theories of Personality: Understanding Person", Pearson, New York, 2008, 5th edition.
2. Luthans F, "Organizational Behaviour", McGraw Hill, New York, 2005, 12th edition.
3. Barron, R.A. & Brian D, "Social Psychology", Prentice Hall of India, 1998, 8th edition.

Reference

3. Adler R.B., Rodman G. & Hutchinson C.C., "Understanding Human Communication", Oxford University Press: New York, 2011.

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 35
Total:	50

Prerequisites for the course: *Problem Solving using C*

Course Learning Outcomes:

CO1: Identify different concept of Personality
CO2: Able to Compare and contrast different personal grooming pertains.
CO3: Able to explore communication beyond language.
CO4: Able to manage oneself while communicating.
CO5: Able to acquire good communication skills and develop confidence.

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –III

Programme:DIPLOMA **Class:**BCA		**Year: II** **Semester: III**
Credits Theory:4Cr	**Subject:**Computer System Architecture	
Course Code: BCA-NEP-304	**Title:**Computer System Architecture	

Course Objectives:
CO1: To learn the concepts regarding microprocessor with 8 bit. To learn the concepts regarding
CO2: Microprocessor with 16 bit. To understand the basic idea of the internal architecture and register configuration of respective devices.
CO3: To understand the programming techniques of with the help of Assembly Language Programming.
CO4: To understand the basic concept of parallel computing.
CO5: To understand significance of pipelining and parallelism, so that the devices used to perform

Nature of Paper: DISCIPLINE SPECIFIC ELECTIVE

Minimum Passing Marks/Credits: 40% Marks

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

Unit	Contents	No. of Lectures Allotted
I	Basic Computer Organization and Design: Instructions and Instruction Codes, Computer Registers, Timing and Control, Instruction Cycle, Register Transfer and Micro Operations-Registration Transfer Language, Register Transfer Instructions, Bus and Memory Transfer Instructions, Arithmetic and Logic Micro-Operations, Shift Micro-Operations, Arithmetic Logic Shift Unit; Memory-Reference Instructions, Input-Output and Interrupts, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.	8
II	**Central Processing Unit:** General Register Organization, Stacks Organization, Instruction Formats, Addressing Modes, RISC, CISC, Parallel Processing, Pipelining, Instruction and Arithmetic Pipeline, Vector Processing, Matrix Multiplication, Array Processors.	8
III	**Computer Arithmetic:** Addition, Subtraction Algorithms; Multiplication Algorithms: Shift and Add Algorithms, Booth's Algorithm; Divisor Algorithms, Floating Point Representations, Arithmetic Operations on Floating-Point Numbers, Decimal Arithmetic Operations.	8
IV	**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Mode of Transfer, Priority Interrupts, Direct Memory Address (DMA), Input/ Output Processor (IOP), Serial Communication.	8
V	**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware	8

Text Books:
1. Morris Manno, "Computer System Architecture", Pearson Education.

2. W. Stallings, “Computer Organisation And Architecture”, Pearson Education.	
Reference 1. Rao, “Prospective in Computer Architecture” , Prentice Hall of India 2. John P. Hayes, “Computer Architecture and Organization”, McGraw-Hill	
Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100
Prerequisites for the course:NIL	

Course Learning Outcomes:

CO1: For a microprocessor system, student should be able to deal with the internalarchitecture 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 goodenough to deal with interrupts internally or externally.

CO2: He/she should be able to understand the basic concepts of Assembly languageprogramming. For a particular data instruction set, student should be having a clear ideaof solving machine language programs using kit. He/she shall be having an idea totackle 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.
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.

CO4: For good networking, a student should be able to draw SIMD interconnections and FFTor a butterfly method system for collision prevention and vector dispatching.

CO5: He/sheshould be able to make Cube Interconnection Network, Shuffle-Exchange and OmegaNetwork.

IIMT UNIVERSITY — MEERUT (U.P.) — Transforming Education System, Transforming Lives

UGC Approved Section 2f & 12B

Format-3

IIMTU-NEPIMPLEMENTATION
Year- II / Semester –III

Programme: Diploma **Class: BCA**	**Year:** II **Semester: III**
Credits Theory:4Cr	**Subject:** Data Analytics
Course Code: BCA-NEP-304	**Title:**Data Analytics

Course Objectives:

CO1: Understand item sets, Clustering, frame works & Visualizations.
CO2: Apply R tool for developing and evaluating real time applications.
CO3: Implement various Data streams.
CO4: Understand and apply Data Analysis Techniques.
CO5: Describe the life cycle phases of Data Analytics through discovery, planning andbuilding.

Nature of Paper: Discipline Specific Elective

Minimum Passing Marks/Credits:40% Marks

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

Unit	Contents	No. ofLectures Allotted
I	**Introduction to Data Analytics**: Sources and nature of data, classification ofdata (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	8
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 generalization, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy modelsfrom data, fuzzy decision trees, stochastic search methods.	8
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.	8

IV	**Frequent Itemset and Clustering:** Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limitedpass algorithm, counting frequent itemsets in a stream, Clustering techniques:hierarchical, K-means, clustering high dimensional data, CLIQUE andProCLUS, frequent pattern-based clustering methods, clustering in non-Euclidean space, clustering for streams and parallelism.	8
V	**Frame Works and Visualization**: Map Reduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems,Visualization: visual data analysis techniques, interaction techniques, systems and applications.	8

Text Book:

1. John Garrett, "Data Analytics for IT Networks: Developing Innovative Use Cases", Pearson Education.
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley.

Reference Book:

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

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks /Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 data gathering of large data from a range of data sources.
CO1: Able to Critically analyse existing Big Data datasets and implementations, taking practicality, and usefulness metrics into consideration.
CO3: Able to perform the role of statistics in the analysis of large of datasets.
CO4: Able to apply advanced knowledge of statistical data analytics as applied to large data sets.
CO5: Employ advanced statistical analytical skills to test assumptions, and to generate and present new information and insights from large datasets.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –III

Programme:UG **Class: BCA**		Year: II Semester:III
Credits Theory: 0 Practical: 2	**Subject: OOPS USING JAVA LAB**	
Course Code: **BCA-NEP-305P**	**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

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 indexOutofBounds 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 2) Presentations /Seminar 3) Assignments 4) Research Project Report/Seminar On Research Project Report	25
5) ESE	25
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

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –III

<table>
<tr><td colspan="2">Programme:Diploma
Class:BCA</td><td colspan="2">Year: II
Semester: III</td></tr>
<tr><td colspan="2">Credits
Theory:4Cr</td><td colspan="2">Subject:Object Oriented Programming Using Java</td></tr>
<tr><td colspan="2">Course Code:
BCA-NEP-301</td><td colspan="2">Title:Object Oriented Programming Using Java</td></tr>
<tr><td colspan="4">Course Objectives:
CO 1: Able to understand the use of OOPs concepts.
CO 2: Able to solve real world problems using OOP techniques.
CO 3: Able to understand the use of abstraction.
CO 4: Able to understand the use of Packages and Interface in java.
CO 5: Able to develop and understand exception handling, multithreaded applications with synchronization.</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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, ArrayDeclaration, Creation, Initialization, String Handling- Predefined Functions in String, String Methods, Vectors, Command-Line Arguments.</td><td>12</td></tr>
<tr><td>II</td><td colspan="2">Classes, Objects and Methods: Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors, Types of Constructors, this & static keyword, Garbage Collection, Inheritance, Types of Inheritance, Creating Multilevel Hierarchy, Method Over Loading & Overriding, Dynamic Method Dispatching, final keyword, Abstract Class.</td><td>12</td></tr>
<tr><td>III</td><td colspan="2">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. Multithreaded Programming: Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority</td><td>12</td></tr>
<tr><td>IV</td><td colspan="2">Managing I/O Files: Introduction, Streams, Stream Classes, File Class, Creation of Files, Reading and Writing to File, Buffering Files, Random Access Files, Interactive I/O. GUI Programming: GUIComponents, AWT, Swings, Event Handling.</td><td>12</td></tr>
<tr><td>V</td><td colspan="2">Introduction to Applet Programming: Introduction to Applet, Applet</td><td>12</td></tr>
</table>

	Architecture, Applet Life Cycle, Applet Class, Applet Tag, Applet Methods, Running the Applet. JDBC: Accessing Databases With Java Database Connectivity	

Text Books:

1. Patrick Naughton and Herbertz Schildt, "Java-2 The Complete Reference", McGraw 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.
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:

CO 1:	Able to understand the use of OOPs concepts.
CO 2:	Able to solve real world problems using OOP techniques.
CO 3:	Able to understand the use of abstraction.
CO 4:	Able to understand the use of Packages and Interface in java.
CO 5:	Able to develop and understand exception handling, multithreaded applications with synchronization.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –III

Programme:UG **Class: BCA**	Year: II Semester:III
Credits Theory: 0 Practical: 2	**Subject:Operating System Lab**
Course Code: **BCA-NEP-306P**	**Title:Operating System Lab**

Course Objectives:
CO1: To Implement the paging Technique 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

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 C programs to implement the various Page Replacement Algorithms	2
II	Write C programs to demonstrate various process related concepts.	2
III	Write C programs to implement the various CPU Scheduling Algorithms	2
IV	Write C programs to simulate CPU scheduling algorithms: FCFS, SJF, and Round Robin.	2
V	Implement the following 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 various disk scheduling algorithms	2
VIII	Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.	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.

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:
Student will be able to:
CO1: Identify the performance of various page replacement algorithms.
CO2: Develop algorithm for deadlock
CO3: Choose the best CPU scheduling algorithm for a given problem instance.

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –IV

Programme: Diploma **Class: BCA**		Year: II Semester: IV
Credits Theory:4Cr	**Subject:** Software Engineering	
Course Code: BCA-NEP-401	**Title:** Software Engineering	
Course Objectives: CO 1: Select and implement different software development process models. CO 2: Extract and analyze software requirements specifications for different projects. Develop CO 3: some basic level of software architecture/design. CO 4: Define the basic concepts and importance of Software project management concepts like cost CO 5: estimation, scheduling and reviewing the progress. Apply different testing and debugging techniques and analyzing their effectiveness.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 40% Marks		
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: 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.	10
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, Behavioral Modeling, Control Specification, Process Specification, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.	10
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 and Programming Support Environment, Quality Metrics for Design Model and Source Code	10
IV	Software Testing: Verification, Validation, Testing Objectives, Unit Testing, Integration Testing, Validation Testing, System Testing, Acceptance Testing,	10

	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.	
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, Configuration Audit, Metrics for Maintenance.	10

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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO 1: Select and implement different software development process models.
CO 2: Extract and analyze software requirements specifications for different projects.
CO 3: Develop some basic level of software architecture/design.
CO 4: Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress.
CO 5: Apply different testing and debugging techniques and analyzing their effectiveness.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –IV

Programme: Diploma **Class: BCA**		Year: II Semester: IV
Credits Theory:4Cr	**Subject:** Data Mining	
Course Code: BCA-NEP-404	**Title:** Data Mining	

Course Objectives:

CO1: To introduce students to basic applications, concepts, and techniques of data mining.
CO2: To develop skills for using recent data mining software to solve practical problems in a variety of disciplines.
CO3: To extract knowledge from data repository for data analysis, frequent pattern, classification and prediction.
CO4: Understand and implement classical models and algorithms in data warehouses and data mining
CO5: Master data mining techniques in various applications like social, scientific and environmental context.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks

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

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Data Mining - Overview, Motivation, Definition & Functionalities, Major issues in Data Mining, Integration of Data Mining System with Data Warehouse System. **Data Preprocessing**: Descriptive Data Summarization, Data Cleaning-Missing Values, Noisy Data, Data Integration and Transformation, Data Reduction-Data Cube Aggregation, Attribute Subset Selection, Dimensionality Reduction, Numerosity Reduction, Discretization and Concept Hierarchy.	10
II	**Association Rules:** Introduction, Frequent Itemsets, Closed Itemsets, Methods to Discover Association Rules, Apriori Algorithm, Multilevel Association Rule Mining, and Rule Evaluation Metrics.	10
III	**Classification and Prediction:** Classification Techniques-Decision Tree, Rule-Based Classification, Bayesian Classification, k-Nearest-Neighbor Classifier, Linear Regression, Accuracy and Error Measures.	10
IV	**Cluster Analysis:** Introduction, Types of Data, Partitioning Methods- k-Means and k-Medoids, Hierarchical Clustering- Chameleon, Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods-Neural Network Approach, Outlier Analysis.	10
V	**Recent Trends and Applications:** Web Mining, Spatial Data Mining, Text Mining, Multimedia Data Mining, Applications of data mining in finance, business, social networks.	10

Text Books:

1. Jiawei Han, Jian Pei, Micheline Kamber, *"Data Mining: Concepts and Techniques"*, Elsevier

Reference

1. Margaret H. Dunham, "*Data Mining: Introductory and Advanced Topics*", Pearson Education.
2. Arun K. Pujari, *"Data Mining Techniques"*, Universities Press
3. 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	10
Seminar On Research Project Report	
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand the functionality of the various data mining and data warehousing component.
CO2: Appreciate the strengths and limitations of various data mining and data warehousing models.
CO3: Explain the analyzing techniques of various data
CO4: Describe different methodologies used in data mining and data ware housing.
CO5: Compare different approaches of data ware housing and data mining with various technologies.

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –IV

Programme: Certificate/Diploma/Degree/ UG(R)/PG/Ph.D. Certificate **Class: All UG Classes of IIMT University**	Year: II Semester: IV
Credits Theory- 3Cr	**Subject: Human values and professional ethics**
Course Code Theory UVE-401	**Title:Human values and professional ethics**

Course Objectives:

CO1: To reinstate the rich cultural legacy and human values of which we are the custodians.

CO2: To focus on professional ethics which are broader indicators of desirable actions vis-à-vis undesirable actions?

CO3: To lay down broader guidelines of values and ethics for internal and external stakeholders.

CO4: To suggest operational guidelines for value-based and ethical practices in the higher educational institutions leading to implementation and monitoring.

CO5: To indicate the outcomes of creating a value-based and ethical culture in HEIs.

CO6: To suggest indicative reinforcement programmes for nurturing human values and ethics in HEIs.

Nature of Paper: Core/DSE/SEC/GE/AECC-AECC

Minimum Passing Marks/Credits:20

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

Unit	Contents(Theory)	No. of Lectures Allotted
I	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education	6
II	Understanding Harmony in the Human Being - Harmony in Myself	6
III	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship	6
IV	Understanding Harmony in the Nature and Existence - Whole existence as Co-existence	6
V	Implications of the above Holistic Understanding of Harmony on Professional Ethics.	6

Suggested Readings: For Theory

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs,Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.

8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantra Shodh, Amravati.
9. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford UniversityPress
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted2008.
13. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	10 marks
2) Presentations /Seminar	05 marks
3) Assignments	
4) Research Project Report	
Seminar On Research Project Report	
5) ESE	35
Total:	50

Prerequisites for the course: First year must be clear for appearing in IIIrd/IVth for the study of this Audit/Qualifying course**- for theory**
Second year must be clear for appearing in VIth Sem for the study of this audit/Qualifying Course **- for theory**

Course Learning Outcomes:

CO1: The learning process for holistic development.
CO2: Impeccable governance.
CO3: Effective institutional management.
CO4: Well laid system of rewards and chastisement.
CO5: Institutional climate where 'rights' enjoy and 'wrongs' are discouraged.

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –IV

Programme: Diploma **Class: BCA**		**Year: II** **Semester:** IV
Credits Theory:4Cr Practical:2Cr	**Subject:** Numerical Analysis	
Course Code: BCA-NEP-404	**Title:** Numerical Analysis	

Course Objectives:

CO1: Basic understanding of numerical Algorithms.
CO2: Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques.
CO3: Use the concepts of interpolation, eigen value problem techniques for mathematical problems arising in various fields.
CO4: Solve initial value and boundary value problems which have great significance in engineering practice using ordinary and partial differential equations.
CO5: Demonstrate elementary programming language, implementation of algorithms and computer programs to solve mathematical problems.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks

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:** Numbers representation on a computing machine with particularization to single precision, double precision, quadruple precision and the Intel 86 family of processors. Definitions of numerical rounding error and chopping error, Discussion of major sources of error in numerical analysis	8
II	**Solution of algebraic equations:** Description of: Bijection algorithm and its coding; Method of False Position and its coding; The Secant algorithm and its coding; The Newton-Raphson algorithm and its coding. Brief discussion of the robustness and relative performance of these algorithm. Properties of the fixed point algorithm xn+1 = g (xn) given x0. Definition of the Lipshitz condition and the notion of a contraction algorithm. - Conditions for convergence of xn+1 = g(xn) ,Error estimation for algorithm xn+1 = g(xn),General notion of the order of an iterative algorithm, Aitken acceleration and Steffensen's algorithm, Solution of systems of algebraic equations	8
III	**Numerical Interpolation:** Polynomial interpolation. Definition of the Lagrange interpolating polynomial, Interpolation based on the Lagrange interpolating polynomial, Newton interpolation using divided differences, Error analysis underlying polynomial interpolation based on, Rolle's theorem. - The Chebyshev Economization and its optimality, Piecewise linear spline, Subpoint quadratic spline, Construction of the cubic spline,Least-squares data fitting; its use and implementation	8

IV	**Solution of linear equations:** Concept of Gaussian elimination, the concept of pivoting and a simple illustration of why pivoting is needed, LU factorization of matrices with and without partial/full pivoting, The Choleski factorization, Matrix inversion Iterative methods, The concept of a matrix norm with simple examples, e.g. the Frobenius norm, The Jacobi iteration algorithm, The Gauss-Seidel algorithm, The Gauss-Seidel algorithm with over-relaxation	8
V	**Numerical calculation of matrix eigenvalues:** Gershgorin's theorem with an example - The Power algorithm, The Inverse Power algorithm, The Jacobi transformation, The Householder transformation, Construction of the Upper Hessenberg matrix, The QR algorithm	8

Text Books:

1. V. A. Patel. Numerical Analysis. Harcourt Brace, College Publishers, 1994.
2. W. Cheney and D. Kincaid. Numerical Mathematics and Computing. Brooks/Cole Publishing Company, 2003.

Reference

1. Numerical Analysis. 9th ed. R.L. Burden and J.D. Faires: Edition Brooks / cole: -73563-538-0-978 .2011136
2. An Introduction to Numerical Analysis. EndreSüli, David F. Mayers Cambridge : -0521810264 - 2003 .0521007941

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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: Discuss robustness and relative performance of different algorithm.
CO2: Able to apply interpolation methods for solving the problems numerically.
CO3: Able to calculate the errors and the rates of convergence.
CO4: Able to evaluate the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
CO5: Able to develop numerical algorithms for the solution of the algebraic eigenvalue problem.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –IV

Programme: Diploma **Class:BCA**	Year: II Semester: IV
Credits Theory:4Cr	**Subject:** Python Programming
Course Code: BCA-NEP-402	**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

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	10
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.	10
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).	10
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.	10

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	10

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)
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	
5) Seminar On Research Project Report	
6) 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- II / Semester -IV

Programme:UG **Class:BCA**		**Year:**II **Semester:**IV
Credits **Theory:** 0 **Practical: 2**	**Subject: Python Programming Lab**	
Course Code: **BCA-NEP-406P**	**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 Pythonϖ Programming.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 50% Marks		
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 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

TextBooks:

1. Pooja Sharma,"Programming in Python",B.P.B. Publications.
2. Mark Summer field, "Programming in Python.
3. A Complete Introduction to the Python Language", Pearson Education.

Reference:

1. Mark Lutz,"Programming Python",O'Reilly Media.
2. Wesley J.Chun,"CorePython Programming", Prentice Hall.
3. Alex Martelli,"Pythonina Nutshell",O' Reilly Media.

Evaluation/Assessment Methodology	
	Max. Marks:50
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report 5) ESE	25 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-NEP IMPLEMENTATION
Year- II / Semester -IV

<table>
<tr><td colspan="2">Programme: UG
Class: BCA</td><td colspan="2">Year: II
Semester: IV</td></tr>
<tr><td>Credits
Practical: 2</td><td colspan="3">Subject: Software Engineering Lab</td></tr>
<tr><td>Course Code:
BCA-NEP-405P</td><td colspan="3">Title: Software Engineering Lab</td></tr>
<tr><td colspan="4">Course Objectives:
Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 50% Marks</td></tr>
<tr><td colspan="4">L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">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</td><td>2</td></tr>
<tr><td>II</td><td colspan="2">Preparation of Software Requirement Specification Document, Design Documents and</td><td>2</td></tr>
<tr><td>III</td><td colspan="2">Identify the classes. Classify them as weak and strong classes and draw the class diagram.</td><td>2</td></tr>
<tr><td>IV</td><td colspan="2">Preparation of Software Configuration Management and Risk Management related documents</td><td>2</td></tr>
<tr><td>V</td><td colspan="2">Study and usage of any Design phase CASE tool</td><td>2</td></tr>
<tr><td>VI</td><td colspan="2">Prepare a SRS document in line with the IEEE recommended standards.</td><td>2</td></tr>
<tr><td>VII</td><td colspan="2">Develop test cases for unit testing and integration testing</td><td>2</td></tr>
<tr><td>VIII</td><td colspan="2">Develop test cases for various white box and black box testing techniques.</td><td>2</td></tr>
<tr><td>IX</td><td colspan="2">Draw the activity diagram</td><td>2</td></tr>
<tr><td>X</td><td colspan="2">Draw the state chart diagram.</td><td></td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">If the course is available as Generic Elective then the students of following departments may opt it.
NA</td></tr>
</table>

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	25 25
Total:	50

Course Learning Outcomes:
Student will be able to:
CO1: Draw a class diagram after identifying classes and association among the
CO2: Graphically represent various UML diagrams, and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially
CO3: Able to use modern engineering tools for specification, design, implementation and testing
CO4: Develop test cases for various white box and black box testing techniques.

IIMTU-NEPIMPLEMENTATION
Year- III / Semester –V

Programme: Degree **Class: BCA**	**Year:** III **Semester:** V
Credits Theory:4Cr	**Subject:** 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 No SQL 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: Discipline Specific Elective

Minimum Passing Marks/Credits:40% Marks

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 localtests, 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, Avroand 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. **NoSQL** Databases: Introduction to No SQL Mongo DB: Introduction, data types,	8

	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 withDatabases, 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, BigInsights and Big Sheets, introduction to Big SQL.	8

Text Book:

1. 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

<table>
<tr><td colspan="2">Programme: Degree
Class: BCA</td><td colspan="2">Year: III
Semester: V</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject: Data communication network</td></tr>
<tr><td>Course Code:
BCA-NEP-503</td><td colspan="3">Title: Data communication network</td></tr>
<tr><td colspan="4">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</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">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</td><td>10</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>10</td></tr>
<tr><td>III</td><td colspan="2">Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services,</td><td>10</td></tr>
<tr><td>IV</td><td colspan="2">Network layer: Logical Addressing, Internetworking, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.</td><td>10</td></tr>
<tr><td>V</td><td colspan="2">Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.</td><td>10</td></tr>
<tr><td colspan="4">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.</td></tr>
</table>

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 2) Presentations /Seminar 3) Assignments	15
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 Theory:4Cr	**Subject:**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

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	10
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 andVideo.	10
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	10
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).	10
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 Handlers, JavaScript Security.	10

Text Books:
1. Aravind Shenoy, "*Thinking in HTML*", Packt Publishing.

<table>
<tr><td colspan="2">2. Suehring "Java Script Step by Step", Prentice Hall India Learning Private Limited.
3. Behrouz A. Forouzan, "Data Communication and Networking", Tata McGraw Hill.</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="2" align="center">Evaluation/Assessment Methodology</td></tr>
<tr><td colspan="2" align="right">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 align="center">15

10

75</td></tr>
<tr><td align="right">Total:</td><td align="center">100</td></tr>
<tr><td colspan="2">Prerequisites for the course: NIL</td></tr>
<tr><td colspan="2">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.</td></tr>
</table>

IIMTU-NEP IMPLEMENTATION
Year- III / Semester -V

Programme: Degree **Class: BCA**	Year: III Semester: V
Credits Theory: 4Cr	**Subject: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

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, InsertionSort, 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:

CO 1: Able to Analyze worst-case running times of algorithms using asymptotic analysis.
CO 2: Able to describe the divide-and-conquer paradigm.
CO 3: Able to analyze various searching and sorting algorithms.
CO 4: Able to implement various sorting techniques.
CO 5: Able to explain the major graph algorithms and their analyses.

IIMTU-NEP IMPLEMENTATION
Year- III / Semester -V

Programme: Degree **Class:BCA**		**Year:**III **Semester:**V
Credits Theory:4Cr Practical:2Cr	**Subject:**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

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; Testing; Going Live; End-User Training; Post Implementation (Maintenance Mode).	8

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: McGraw-Hill

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: *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:UG **Class:BCA**	Year: III Semester:V
Credits Theory: 0 Practical: 2	**Subject: 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

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: UG **Class: BCA**		Year: III Semester: V	
Credits Practical: 2	**Subject: 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 Javascript and XML. CO3: Develop Java programs for window/web-based applications.			
Nature of Paper: Core			
Minimum Passing Marks/Credits: 50% Marks			
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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	25
5) ESE	25
Total:	50

Course Learning Outcomes:
Student will be able to:
CO1: Write Java programs for window/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

Programmed: Degree **Class:BCA**	Year: III Semester: VI
Credits Theory:4Cr Practical: 2Cr	**Subject:**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

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 ProblemSolving, 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 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: Artificial Intelligence	

Course Learning Outcomes:
CO 1: Learn about Artificial Intelligence, AI tasks and AI problem solving technique.
CO 2: Learn study the concepts Propositional logics, predicate Logic.
CO 3: Learn the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO 4: Learn concepts of Prolog and Implement the Prolog Program.
CO 5: Learn concepts of Expert system and Learning.

Format-3

IIMTU-NEPIMPLEMENTATION
Year- III / Semester –VI

Programme: Degree **Class:BCA**	**Year:** III **Semester:**VI
Credits Theory:4Cr	**Subject:** 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 (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 Ethical Hacking:**Key issues plaguing the information security world, incident management process, and penetration testing, **Footprinting 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. 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

Programme: Degree **Class:BCA**		**Year:**III **Semester:VI**
Credits Theory:4Cr	**Subject:** 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

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	15
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 Theory:4Cr	**Subject:**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

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 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 defense 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 2) Presentations /Seminar 3) Assignments	15
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.

IIMTU-NEP IMPLEMENTATION
Year- III / Semester -VI

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

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

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks

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.	8

	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.	

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 2) Presentations /Seminar 3) Assignments	15
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: UG **Class: BCA**	Year: III Semester:VI
Credits Practical: 2	**Subject: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

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 2) Presentations /Seminar 3) Assignments 4) Research Project Report/Seminar On Research Project Report	25
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.

IIMTU-NEP IMPLEMENTATION
Year- III / Semester -VI

Programme:UG **Class:BCA**	**Year**: III **Semester**:VI
Credits Practical: 2	**Subject: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

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, McGraw Hill.

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

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	25 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.

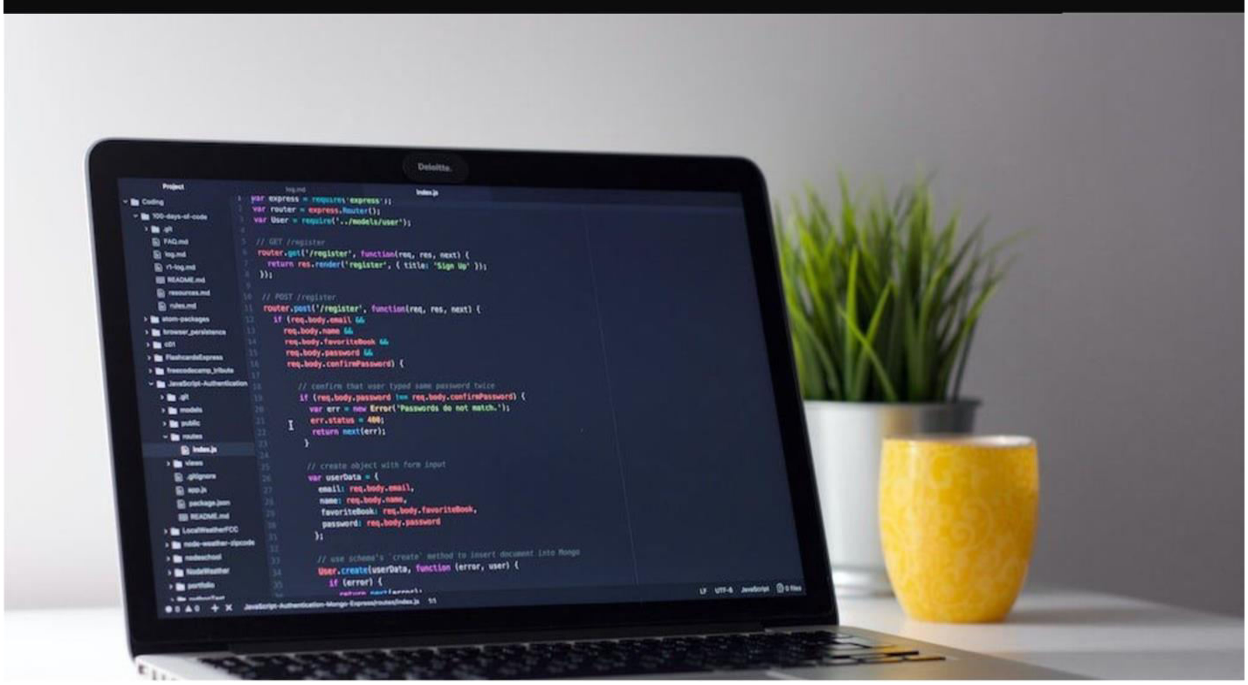
CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of social media platforms.

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.

School of Computer Science & Applications

ACADEMIC HAND BOOK



Ordinance & Academic Regulations
BCA (Cloud and Cyber Security)

Index

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 LOC Finculcation 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 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 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 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 ApplicationProgramme 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 projectreports.

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. ASSESMENT 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 – ASSESMENT 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 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/ACEDIMIC 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 sub stantiated.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 andCentrallegisolationsprovidestringentpunishmentsincludingimprisonment.Oncetheinvolvementofastudent(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) Semester - I											
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**							
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**	
1	BCA-NEP-101	Problem Solving using C	C1	4	0	0	25	75	100	4	
2	BCA-NEP-111	SPT-I (Introduction to Cloud)	C2	4	0	0	25	75	100	4	
3	BCA-NEP-104	1. Mathematics-I 2. Discrete Mathematics	DSE	4	0	0	25	75	100	4	
4	NHU-111	English Communication	AECC	3	0	0	15	35	50	3	
5	BCA-NEP-105P	Problem Solving using C Lab	CORE LAB 1	0	0	4	25	25	50	2	
6	BCA-NEP-112P	SPT-I (Introduction to Cloud Lab)	CORE LAB 2	0	0	4	25	25	50	2	
		Grand Total		**15**	**0**	**8**	**140**	**310**	**450**	**19**	
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: STUDENT CAN TAKE NCC (GENCC-101) AS A GENERAL ELECTIVE/OPTIONAL COURSE AND CERTIFICATE WILL BE PROVIDED AFTER COMPLETION OF NCC COURSE.											

BCA (CLOUD COMPUTING AND CYBER SECURITY) Semester - II										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
1	BCA-NEP-201	Data Structure and Algorithms using C	C1	4	0	0	25	75	100	4
2	BCA-NEP-211	SPT-II (Linux & Administration)	C2	4	0	0	25	75	100	4
3	BCA-NEP-204	1. Mathematics-II 2. Optimization Techniques	DSE	4	0	0	25	75	100	4
4	*Code will be decided by parent department	GE-I (To be opted by the students as per the given electives in the list attached)	GE (Mandatory)	4	0	0	25	75	100	4
5	NHU-112	Environmental & Ecology	AECC	3	0	0	15	35	50	3
6	BCA-NEP-205P	Data Structure and Algorithms using C Lab	CORE LAB 1	0	0	4	25	25	50	2
7	BCA-NEP-212P	SPT-II (Linux & Administration Lab)	CORE LAB 2	0	0	4	25	25	50	2
8	BCA-NEP-207P	MOOC/NPTEL	SEC	4	0	0	50	0	50	4
		Grand Total		**23**	**0**	**8**	**215**	**385**	**600**	**27**
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)
Semester - III

S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
1	BCA-NEP-301	OOPS using JAVA	C1	4	0	0	25	75	100	4
2	BCA-NEP-311	SPT-III (Advanced Cloud Security)	C2	4	0	0	25	75	100	4
3	BCA-NEP-304	1. Computer System Architecture 2. Data Analytics	DSE	4	0	0	25	75	100	4
4	BCA-NEP-303	Communication Skill & Personality Development	AECC	3	0	0	15	35	50	3
5	BCA-NEP-305P	OOPS using JAVA Lab	CORE LAB 1	0	0	4	25	25	50	2
6	BCA-NEP-312P	SPT-III (Advanced Cloud Security Lab)	CORE LAB 2	0	0	4	25	25	50	2
		Grand Total		**15**	**0**	**8**	**140**	**310**	**450**	**19**

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: STUDENT CAN TAKE NCC (GENCC-101) AS A GENERAL ELECTIVE/OPTIONAL COURSE AND CERTIFICATE WILL BE PROVIDED AFTER COMPLETION OF NCC COURSE.

BCA (CLOUD COMPUTING AND CYBER SECURITY) Semester - IV										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
1	BCA-NEP-401	Software Engineering	C1	4	0	0	25	75	100	4
2	BCA-NEP-411	SPT-IV	C2	4	0	0	25	75	100	4
3	BCA-NEP-404	1. Data Mining 2. Numerical Analysis	DSE	4	0	0	25	75	100	4
4	*Code will be decided by parent department	GE-II(To be opted by the students as per the given electives in the list attached)	GE-II (Mandatory)	4	0	0	25	75	100	4
5	UVE-401	Human Values and Professional Ethics	AECC	3	0	0	15	35	50	3
6	BCA-NEP-405P	Software Engineering Lab	CORE LAB 1	0	0	4	25	25	50	2
7	BCA-NEP-412P	SPT-IV Lab	CORE LAB 2	0	0	4	25	0	50	2
8	BCA-NEP-407P	MOOC/NPTEL	SEC	4	0	0	50	0	50	4
		Grand Total		**23**	**0**	**8**	**215**	**360**	**600**	**27**
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										

<table>
<tr><th colspan="11">BCA (CLOUD COMPUTING AND CYBER SECURITY)
Semester - V</th></tr>
<tr><th rowspan="2">S. No.</th><th rowspan="2">Subject Code</th><th rowspan="2">Subject Name</th><th rowspan="2">Course Type</th><th colspan="7">Evaluation Scheme</th></tr>
<tr><th colspan="3">Periods</th><th>Internal Marks</th><th>External Marks</th><th>Total Marks</th><th>Credits</th></tr>
<tr><td>1</td><td>BCA-NEP-511</td><td>SPT-V</td><td>C1</td><td>4</td><td>0</td><td>0</td><td>25</td><td>75</td><td>100</td><td>4</td></tr>
<tr><td>2</td><td>BCA-NEP-513</td><td>SPT-VI</td><td>C2</td><td>4</td><td>0</td><td>0</td><td>25</td><td>75</td><td>100</td><td>4</td></tr>
<tr><td>3</td><td>BCA-NEP-503</td><td>1. Data Communication Network
2. ERP
3. Big Data</td><td>DSE</td><td>4</td><td>0</td><td>0</td><td>25</td><td>75</td><td>100</td><td>4</td></tr>
<tr><td>4</td><td>RP-I AUDIT</td><td>Research Project-I@</td><td>AUDIT</td><td>0</td><td>0</td><td>0</td><td>50</td><td>0</td><td>50</td><td>NC</td></tr>
<tr><td>5</td><td>BCA-NEP-IP-I</td><td>Internship</td><td>Industrial Internship (Mandatory)</td><td>0</td><td>0</td><td>10</td><td>50</td><td>0</td><td>50</td><td>5</td></tr>
<tr><td>6</td><td>BCA-NEP-512P</td><td>SPT-V Lab</td><td>CORE LAB 1</td><td>0</td><td>0</td><td>4</td><td>25</td><td>25</td><td>50</td><td>2</td></tr>
<tr><td>7</td><td>BCA-NEP-514P</td><td>SPT-VI Lab</td><td>CORE LAB 2</td><td>0</td><td>0</td><td>4</td><td>25</td><td>25</td><td>50</td><td>2</td></tr>
<tr><td></td><td></td><td>Grand Total</td><td></td><td>12</td><td>0</td><td>18</td><td>225</td><td>275</td><td>500</td><td>21</td></tr>
<tr><td colspan="11">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</td></tr>
<tr><td colspan="11">L- Lecture, T- tutorials, P- Practical (Labs), NC- Non-Credit Course</td></tr>
<tr><td colspan="11">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</td></tr>
</table>

BCA (CLOUD COMPUTING AND CYBER SECURITY) Semester - VI										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
1	BCA-NEP-611	SPT-VII	C1	4	0	0	25	75	100	4
2	BCA-NEP-613	SPT-VIII	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 Lab	CORE LAB 1	0	0	4	25	25	50	2
6	BCA-NEP-614P	SPT-VIII 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

IIMTU-NEP IMPLEMENTATION
CBCS: Statement of Credit Distribution

College/School:SCHOOL OF COMPUTER SCINECE AND APPLICATIONS Programme: BCA [CLOUD AND CYBER SECURITY] Duration: 3 YEARS Annual/Semester - SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee)

Minimum Credit Score Requiredfor Certificate (40)	First year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP)	Prerequisite
CERTIFICATE	First Year Credit (46)	I	Problem Solving using C (Th. 4 Cr. + P 2Cr.) SPT-I (Introduction to Cloud) (Th. 4 Cr.+ P 2Cr.)	English Communication (Th. 3 Cr.)		1. Mathematics I 2. Discrete Mathematics (Th. 4 Cr.)			
		II	Data Structure Algorithms using C (Th. 4 Cr. + P 2Cr.) SPT-II (Linux and Administration) (Th. 4 Cr. + P 2Cr.)	Environment &Ecology (Th. 3 Cr.)	MOOCS /NPTEL 4 Cr.	1. Mathematics-II 2. Optimization Techniques (Th. 4 Cr.)	GE-I (Mandatory) 4 Cr.		Problem Solving using C Mathematics I

Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.

College/School:SCHOOL OF COMPUTER SCINECE AND APPLICATIONS Programme: BCA [CLOUD AND CYBER SECURITY] Duration: 3 YEARS Annual/Semester – SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee) Provision to change the stream onwards

Minimum Credit Score Requiredfor Diploma (80)	Second year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP)	Prerequisite
DIPLOMA	Second Year Credit (46)	III	OOPS using JAVA (Th. 4 Cr.+ P 2Cr.) SPT-III (Advanced Cloud Security) (Th. 4 Cr.+ P 2Cr.)	Communication Skill & Personality Development (Th. 3 Cr.)	.	1. Computer System Architecture 2. Data Analytics (Th. 4 Cr.)			
		IV	Software Engineering (Th. 4 Cr. + P 2Cr.) SPT-IV (Th. 4 Cr.+ P 2Cr.)	Human Values and Professional Ethics (Th. 3 Cr.)	MOOCS/NPTEL 4 Cr.	1. Data Mining 2. Numerical Analysis (Th. 4 Cr.)	GE-II (Mandatory) 4 Cr.		

Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.

College/School:SCHOOL OF COMPUTER SCINECE AND APPLICATIONS Programme: BCA [CLOUD AND CYBER SECURITY] Duration: 3 YEARS Annual/Semester - SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee) Provision to change the Core Papers (Main Subject)

Minimum Credit Score Required For Degree (120)	Third year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP) /Industrial Internship /Industrial Project	Prerequisite
DEGREE	Third Year Credit (50)	V	SPT-V (Th. 4 Cr.+ P 2Cr.) SPT-VI (Th. 4 Cr.+ P 2Cr.)			1. Data Communication Network 2. ERP 3. BIG Data (Th. 4 Cr.)		RP-I (AUDIT) Non-Credit Research Project-I Internship (5 Cr.)	
		VI	SPT-VII (Th. 4 Cr. + P 2 Cr.) SPT-VIII (Th. 4 Cr. + P 2 Cr.)		MOOCS/NPTEL 4 Cr.	1. Mobile Computing 2. E-Commerce 3. Real Time System (Th. 4 Cr.)	GE-III (Mandatory) 4 Cr.	RP-II (AUDIT) Non-Credit Research Project-II Industrial Project (5 Cr.)	

Format-2

Format-2

IIMTU-NEP Implementation: 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	FIRST YEAR (46 Cr.)	SEMESTER - I (19 Cr.)	i) C1 (Th. 4 Cr. + P 2 Cr.) ii) AECC-I iii) DSE-I	4 2 3 4	4 4 3 4	45 10 40 45	Problem Solving using C Problem Solving using C lab English Communication 1. Mathematics-I 2. Discrete Mathematics	5 5 5		
			ii) C2 (Th.4 Cr. + P 2 Cr)	4 2	4 4	45 10	@SPT – I @SPT - I Lab	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 – II (27 Cr.)	i) C3 (Th. 4 Cr. + P 2 Cr.) ii) AECC-II iii) SEC-I & II iv) DSE-II v) GE-I	4 2 3 4 4 4	4 4 3 4 4 4	45 10 40 40 45 45	Data Structure Algorithms using C Data Structure Algorithms using C Lab Environment & Ecology MOOCS (NPTEL) 1. Mathematics-II 2. Optimization Techniques #To be selected from other School	5 5 5 5 5		
			ii) C4 (Th.4Cr. + P 2 Cr.)	4 2	4 4	45 10	@SPT – II @SPT - II Lab	5		

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.

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 (46 Cr.)	SEMESTER –III (19 Cr.)	i) C5 (Th. 4 Cr. + P 2 Cr.) ii) AECC-III iii) DSE-III	4 2 3 4	4 4 3 4	45 10 40 45	OOPS using Java OOPS using Java Lab Communication Skill & Personality Development 1. Computer System Architecture 2. Data Analytics	5 5 5		
			i) C6 (Th. 4 Cr. + P 2 Cr.)	4 2	4 4	45 10	@SPT – III @SPT - III Lab	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 (27 Cr.)	i) C7 (Th. 4 Cr. + P 2 Cr.) ii) AECC-IV iii) SEC-III & IV iv) DSE-IV v) GE-II	4 2 3 4 4 4	4 4 3 4 4 4	45 10 40 40 45 45	Software Engineering Software Engineering Lab Human values and Professional Ethics MOOCS (NPTEL) 1. Data Mining 2. Numerical Analysis #To be opted from other School	5 5 5 5 5		
			ii) C8 (Th. 4 Cr. + P 2 Cr.)	4 2	4 4	45 10	@SPT – IV @SPT - IV Lab	5		

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 (50 Cr.)	SEMESTER –V (21 Cr.)	i) C9 (Th. 4 Cr. + P 2 Cr.) ii) DSE-V	4 2 4	4 4 4	45 10 45	@SPT – V @SPT - V Lab 1. Data Communication Network 2. ERP 3. BIG Data	5 5		
			ii) C10 (Th. 4 Cr. + P 2 Cr.)	4 2	4 4	45 10	@SPT – VI @SPT - VI Lab	5		
			iii) Research Project iv) Internship (Mandatory)	NC 5	5	10	Internship			

		SEMESTER –VI (29 Cr.)	i) C11 (Th. 4 Cr. + P 2 Cr.) ii) SEC-V & VI iii) DSE-VI iv) GE-III	4 2 4 4 4	4 4 4 4 4	45 10 40 45 45	@SPT – VII @SPT - VII Lab MOOCS (NPTEL) 1.Mobile Computing 2. E-Commerce 3. Real Time System #To be opted from other School	5 5 5 5		
			ii) C12 (Th. 4 Cr. + P 2Cr.)	4 2	4 4	45 10	@SPT – VIII @SPT - VIII Lab	5		
			iii) Research Project iv) Industrial Project (Mandatory)	NC 5	5	10	Industrial Project			

Annexure -2

List of SPT Subjects –

1. Introduction to Cloud
2. Linux and Administration
3. Advanced Cloud Security
4. Advanced Cloud

Format-3

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class:BCA(C& CS)**	**Year: I** **Semester: I**
Credits **Theory**:4Cr	**Subject:** Introduction to Cloud (SPT-I)
Course Code: BCA-NEP-111	**Title:** Introduction to Cloud

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: Core

Minimum Passing Marks/Credits: 40% Marks

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	10

	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 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. RajkumarBuyya, "Mastering Cloud Computing", Tata McGraw-Hill Education.
2. RajkumarBuyya, 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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO 1: 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.
CO 2: Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.
CO 3: Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.
CO 4: Analyse various cloud programming models.
CO 5: Apply the models to solve problems on the cloud.

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

<table>
<tr><td colspan="2">Programme: Certificate
Class: BCA(C& CS)</td><td>Year: I
Semester: I</td></tr>
<tr><td>Credits
Theory:4Cr
Practical:2Cr</td><td colspan="2">Subject: Problem Solving using C</td></tr>
<tr><td>Course Code:
BCA-NEP-101</td><td colspan="2">Title: Problem Solving using C</td></tr>
<tr><td colspan="3">Course Objectives:
CO 1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.
CO 2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements
CO 3: Students will be familiar with concept of Arrays, Pointers, Functions, categories of function and recursion.
CO 4: Students will be able to develop Program with Structure; learn Union and Complete String Operations.
CO 5: Students will be familiar with File handling programs to perform read write operations.</td></tr>
<tr><td colspan="3">Nature of Paper: Core</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="3">L:4
T:0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1 Credit
(4Hrs./Week=4Credits)</td></tr>
</table>

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, Introduction to Pre-processor Directives: #include, #define, printf(), scanf(), Declaration, Assignment, Operators, Expressions, Statements, Arithmetic Expressions.	10
II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, Ternary Operator, goto Statement, Loops (for, while, do-while) in C, break and continue Statements, Nested Loops.	10
III	**Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data from Array, Using Arrays with Functions, Multi-Dimensional Arrays. **Pointers:** Basics, Pointer and Function, Array of Pointers. **Storage Classes:** Automatic, External, Static & Register. **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.	9
IV	**String:** Declaring, Initializing, String Manipulation Functions, String Input	8

	and Output Functions, String Pointer, Array of Strings, Passing String to Function. **Structure and Union:** Basic of Structures, Structures and Functions, Array of Structures, Pointer to Structure, Union.	
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(), ftell(), feof( ), etc.	8

Text Books:

1. E. Bala Guruswamy, “*Programming in ANSI C”,* Tata Mc. Graw-Hill education.
2. YashwantKanetkar, *“Let us C”,* BPB Publications

Reference:

1. V Rajaraman, “*Computer Basics and C Programming*”, PHI Learning
2. Ashok N. Kamthane, “*Programming in C*”, Pearson Education.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 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

IIMTU-NEPIMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class: BCA(C& CS)**	**Year:** I **Semester: I**
Credits Theory:4Cr	**Subject:** Discrete Mathematics
Course Code: BCA-NEP-104	**Title:** Discrete Mathematics

Course Objectives:

CO1: Identify and prove properties of Algebraic Structures like Groups, Rings and Fields.
CO2: Formulate and solve recurrences and recursive functions.
CO3: Apply the concept of combinatorics to solve basic problems in discrete mathematics.
CO4: Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions.
CO5: Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic.

Nature of Paper: Discipline Specific Elective

Minimum Passing Marks/Credits:40% Marks

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	**Set Theory:** Introduction, Size of set sand Cardinals, Venn diagrams, Combination of sets, Multi sets, ordered pairs and Set Identities. **Functions:** Definition, Types of functions, Operations on functions, recursively defined functions. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation.	8
II	**Posets, Hasse Diagram and Lattices:** Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction on flattices, 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	**Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic. **Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection.	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 groups, Homomorphism and Isomorphism of groups. **Rings and Fields:** Definition and elementary properties of Rings and Fields.	8

V	**Natural Numbers:** Introduction, Piano's axioms, Mathematical Induction, Strong Induction and Induction with Nonzero 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 Pigeonhole principle, Polya's Counting theorem.	8

Text Book:
1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Mc. GrawHill, 2006.
2. B. Kolman, R.C. Bus by and S.C. Ross, "Discrete Mathematics Structures", Prentice Hall, 2004.

Reference Book:
1. R.P. Girimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley, 2004.
2. Y. N. Singh, "Discrete Mathematical Structures", Wiley-India, First edition, 2010.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 identify the properties of functions and relations.
CO2: 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

IIMTU-NEPIMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class: BCA(C& CS)**	Year: I Semester: I
Credits Theory: 3	**Subject: English communication**
Course Code: NHU-111	**Title: English Communication**

Course Objectives:

CO1:	It aims to improve English communication skills i.e., Listening, speaking, reading, & writing.
CO2:	To develop potential skills to deal confidently in English with diverse situations in the external world.
CO3:	To work in a collaborative manner & communicate effectively in English.
CO4:	To get exposure to various activities related to English Communication which will enable the learners to take initiative, solve problems, and demonstrate a positive work ethics.

Nature of Paper: AECC

Minimum Passing Marks/Credits: 40% Marks

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	English Communication skills: listening skills, speaking skills, reading skills, writing skills. Starting and sustaining a conversation. Process of Communication, Essential of effective Communication, Barriers to Communication, Role of Communication	8
II	Public Speech, Delivering skills, Group discussion, Communication in seminars, Conferences and Committees Parts of Speech- Noun, Pronoun, Adjective, Verb, Adverb, Conjunction, Preposition, Interjection, Articles, Common errors in English	8
III	Presentation: Features, Styles, Use of visual aids, Creating a Dynamic Presentation, Presentation and interaction, Telephonic conversation & Basic Etiquette.Non Verbal Communication: Meaning, Types and Importance. Listening: Difference between Listening and Hearing.	8
IV	Word Skills-Synonyms, Antonyms, Words often Confused, Idioms, Phrases, Phrasal Verbs.	8
V	Drafting of Notices, Agendas, Minutes, Job Application letter, CV, Business Correspondence, Essentials of Effective Business Correspondence, Types and Structure of Business Letter.	8

Text Books:

- English Grammar and Composition by Wren & Martin
- Effective Communication and Soft Skills by Nitin Bhatnagar
- The ACE of Soft Skills: Attitude, Communication and Etiquette for Success by Gopalaswamy Ramesh and Mahadevan Ramesh**.**

Reference

- English Grammar in Use by Raymond Murphy
- English Grammar Composition and Usage by J.C. Nesfield

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination 2) Presentations /Seminar/Attendance 3) Assignments/TA	15
4) Research Project Report Seminar On Research Project Report	Nil
5) ESE	35
Total:	50

Prerequisites for the course: NIL

Course Learning Outcome

CO1: To get knowledge about communication skills.
CO2: To understand about use of grammar.
CO3: To understand about presentation.
CO4: To get information about how to face interview and public.
CO5: To get knowledge about telephonic conversation & etiquette.

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class: BCA(C& CS)**	**Year: I** **Semester: I**
Credits Theory:4Cr	**Subject:**Mathematics-I
Course Code: BCA-NEP-104	**Title:** Mathematics-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, Methods of Integration Substitution.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks

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, Definite Integral, Simple Problems of Line Integral.	8

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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO 1: Compute the rank and inverse of a matrix and solve system of linear equations.

CO 2: Computation of Limits of Various Types of Functions, Continuity over an Interval, to find Intermediate Value Theorem and type of Discontinuities.

CO 3: Understand the Derivatives, Chain Rule, Derivatives of Composite Functions, Logarithmic Differentiation and successive Differentiation.

CO 4: Use of different theorems like Rolle's Theorem, Mean Value Theorem, Leibnitz Theorem, Partial Differentiation, Euler's Theorem.

CO 5: 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

Program: UG **Class: BCA(C & CS)**		Year: I Semester: I	
Credits Theory: 0 Practical: 2	**Subject: Problem-Solving using C Lab**		
Course Code: **BCA-NEP-105P**	**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			
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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	25 25
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

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme:UG **Class:BCA(C&CS)**	Year: I Semester:I
Credits Practical: 2	**Subject:SPT-I (Introduction to Cloud Lab)**
Course Code: BCA-NEP-112P	**Title:SPT-I (Introduction to Cloud Lab**

Course Objectives:
CO1: Understand the fundamental concepts and principles of cloud computing.
CO2: Familiarize students with the major cloud service models, such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).
CO3: Provide hands-on experience in working with popular cloud platforms, such as Amazon Web Services (AWS), Microsoft Azure, or Google Cloud Platform (GCP).
CO4: Learn how to deploy and manage virtual machines, containers, and server less functions in the cloud environment.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks

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. Internet of Things: Principles and Paradigms by Rajkumar Buyya, Amir Vahid Dastjerdi.
2. Internet of Things by Raj Kamal, Mc. Graw-Hill Education.
3. Blockchain Revolution: How the Technology Behind Bitcoin and Other Crypto currencies is Changing the World by Don Tapscott, Alex Tapscott.
4. Fog Computing: Theory and Practice by Assad Abbas; Samee U. Khan; Albert Y. Zomaya, Wiley

Telecom 2020. 5. Fog and Edge Computing: Principles and Paradigms by Satish Narayana Srirama, Rajkumar Buyya, Wiley 2019	
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) Research Project Report Seminar On Research Project Report 5) ESE	25 25
Total:	50

Course Learning Outcomes:
Student will be able to :

CO1: Demonstrate a comprehensive understanding of cloud computing concepts and principles.

CO2: Apply knowledge of cloud service models (IaaS, PaaS, SaaS) to select appropriate solutions for different business scenarios.

CO3: Utilize cloud platforms (such as AWS, Azure, or GCP) to deploy and manage virtual machines, containers, and server less functions.

CO4: Configure and manage cloud storage, databases, and networking resources effectively.

CO5: Apply cloud computing knowledge and skills to address real-world challenges and scenarios effectively.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

Programme: Certificate **Class: BCA(C& CS)**	**Year: I** **Semester: II**
Credits Theory:4Cr Practical:2Cr	**Subject:** Data Structure Algorithms using C
Course Code: BCA-NEP-201	**Title:** Data Structure Algorithms using C

Course Objectives:

CO1: Demonstrate familiarity with major algorithms and data structures.

CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.

CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.

CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.

CO5: Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks

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 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, Deques, 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,	8

	Deletion, Traversal; Traversal of Binary Trees; Application of Binary Trees; 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. 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

Max. Marks 100

1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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: Demonstrate familiarity with major algorithms and data structures.

CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.

CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.

CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.

CO5: Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

Format-3

IIMTU-NEPIMPLEMENTATION
Year-I / Semester-II

<table>
<tr><td colspan="2">Programme: Certificate
Class: BCA(C& CS)</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td>Credits
Theory:3Cr</td><td colspan="3">Subject: Environment and Ecology</td></tr>
<tr><td>Course Code:
NHU-112</td><td colspan="3">Title: Environment and Ecology</td></tr>
<tr><td colspan="4">Course Objectives:
CO1: Creating the awareness about environmental problems among people
CO2: Imparting basic knowledge about the environment and its allied problems.
CO3: Developing an attitude of concern for the environment.
CO4: Motivating public to participate in environment protection and environment improvement.
CO5: Grasp the significance and issues related to ecosystems, biodiversity and natural resources.</td></tr>
<tr><td colspan="4">Nature of Paper: AECC</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="4">L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. ofLectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">The Multidisciplinary Nature Of Environmental Studies:
Definition, Scope and Importance, Need for Public Awareness.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">Natural Resources: Renewable And Non-Renewable Resources;
Natural Resources and Associated Problems: -
A. Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies. Timber Extraction, Mining, Dams and Their Effects on Forests and Tribal People.
B. Water Resources: Use and Over-Utilization of Surface and Ground Water, Floods, Drought, Conflicts Over Water, Dams-Benefits and Problems.
C. Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies.
D. Food Resources: World Food Problems, Changes Caused By Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies.
E. Energy Resources: Growing Energy Needs, Renewable and Non renewable Energy Sources, Use of Alternate Energy Sources, Case Studies
F. Land Resources: Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification.
G. Role of an Individual In Conservation Of Natural Resources; Equitable Use of Resources for Sustainable Lifestyles</td><td>8</td></tr>
</table>

III	**Ecosystems:** Concept of an Ecosystem; Structure and Function of an Ecosystem; Producers, Consumers and Decomposers; Energy Flow in the Ecosystem; Ecological Succession; Food Chains, Food Webs and Ecological Pyramids; Introduction, Types, Characteristic Features, Structure And Function of the Following Ecosystem: - A. Forest Ecosystem B. Grassland Ecosystem C. Desert Ecosystem D. Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries)	8
IV	**Biodiversity and Its Conservation:** Introduction – Definition: Genetic, Species and Ecosystem Diversity; Bio geographical Classification of India; Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, and Aesthetic and Option Values; Biodiversity at Global, National and Local Levels; India as a Mega-Diversity Nation; Hot-Sports of Biodiversity; Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts; Endangered and Endemic Species of India; Conservation of Biodiversity: In-Situ and Ex-Situ Conservation of Biodiversity.	8
V	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Pollution; Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes; Role of an Individual in Prevention of Pollution; Pollution Case Studies; Disaster Management: Floods, Earthquake, Cyclone and Landslides.	8

Text Books:

1. A. Basak, "*Environmental Studies",* Pearson Education.
2. Anil Kumar De, "*Environmental Studies*", New Age International

Reference:

1. J. P. Sharma, "*Environmental Studies*", University Science Press.

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	15
5) ESE	35
Total:	50

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Student will be able to recognize the physical and biological components of earth's system.
CO2: Student will be able to examine all environmental issues.
CO3: Student will be able to do independent research on human interaction with the environment.
CO4: Student will be able to develop and attitude of concern for the environment.
CO5: Student will be able to motivate public to participate in environmental protection.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

<table>
<tr><td colspan="2">Programme: Certificate
Class: BCA(C& CS)</td><td colspan="2">Year: I
Semester:II</td></tr>
<tr><td>Credits
Theory:4Cr
Practical:2Cr</td><td colspan="3">Subject: LINUX ADMINISTRATION WITH SCRIPTING(SPT-II)</td></tr>
<tr><td>Course Code:
BCA-NEP-211</td><td colspan="3">Title: LINUX ADMINISTRATION WITH SCRIPTING</td></tr>
<tr><td colspan="4">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, lsetc.
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</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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.</td><td>10</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>10</td></tr>
<tr><td>III</td><td colspan="2">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, Enchance User Security, Apache Server.</td><td>10</td></tr>
<tr><td>IV</td><td colspan="2">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)</td><td>10</td></tr>
</table>

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: 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

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

Programme: Certificate **Class:BCA(C& CS)**	**Year: I** **Semester: II**
Credits Theory: 4Cr	**Subject:** Mathematics-II
Course Code: BCA-NEP-204	**Title:** Mathematics-II

Course Objectives:
CO 1: Apply mathematical concepts and principles to perform computations.
CO 2: Apply mathematics to solve problems.
CO 3: Create, use and analyze graphical representations of mathematical relationships.
CO 4: Communicate mathematical knowledge and understanding.
CO 5: Apply technology tools to solve problems.

Nature of Paper: DSE

Minimum Passing Marks/Credits: 40% Marks

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

Unit	Contents	No. of Lectures Allotted
I	**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
II	**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
III	**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
IV	**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	8
V	**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 heat conduction equations, Laplace equation in two dimension, Equation of transmission lines	8

Text Books:
1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley & 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.

Reference:
1. H. K. Dass, "Introduction to Engineering Mathematics", S. Chand, New Delhi
2. R. Wylie, "Advanced Engineering Mathematics", Mc. Graw-Hill.

Evaluation/Assessment Methodology

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

Prerequisites for the course: MATHEMATICS-I

Course Learning Outcomes:

CO 1: Apply mathematical concepts and principles to perform computations.
CO 2: Apply mathematics to solve problems.
CO 3: Create, use and analyze graphical representations of mathematical relationships.
CO 4: Communicate mathematical knowledge and understanding.
CO 5: Apply technology tools to solve problems

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

Programme: Certificate **Class: BCA(C& CS)**	**Year: I** **Semester: II**
Credits Theory:4Cr	**Subject:** Optimization Techniques
Course Code: BCA-NEP-204	**Title:** Optimization Techniques

Course Objectives:

CO1: Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.

CO2: Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function).

CO3: The problem formulation by using linear, dynamic programming, game theory and queuing models.

CO4: The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.

CO5: Formulation of mathematical models for quantitative analysis of managerial problems in industry.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks

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

Unit	Contents	No. of Lectures Allotted
I	**LINEAR PROGRAMMING (L.P):** Revised Simplex Method, Duel simplex Method, Sensitivity Analysis **DYNAMIC PROGRAMMING (D.P):** Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.	8
II	**CLASSICAL OPTIMIZATION TECHNIQUES:** Single variable optimization without constraints, Multi variable optimization without constraints, multivariable optimization with constraints –method of Lagrange multipliers, Kuhn-Tucker conditions. **NUMERICAL METHODS FOR OPTIMIZATION:** Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.	8
III	**MODERN METHODS OF OPTIMIZATION:** **GENETIC ALGORITHM (GA):** Differences and similarities between conventional and evolutionary algorithms, working principle, Genetic Operators- reproduction, crossover, mutation **GENETIC PROGRAMMING (GP):** Principles of genetic programming, terminal sets, functional sets, differences	8

	between GA & GP, Random population generation. Fuzzy Systems: Fuzzy set Theory, Optimization of Fuzzy systems	
IV	**QUEUING THEORY** Queuing Model, poison and exponential distributions -Queues with combined arrivals and departures-random and series queues.	8
V	**INTEGER PROGRAMMING:** Graphical Representation, Gomory's Cutting Plane Method, Balas' Algorithm for Zero–One Programming, Branch-and-Bound Method. **APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS:** Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.	8

Text Books:

1. J. K. Sharma, "Operations Research", Macmillan, 5thEdition, 2012.
2. R. Pannerselvan, "Operations Research", 2ndEdition, PHI Publications, 2006.

Reference

1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2013.
2. Maurice Saseini, Arhur Yaspan, Lawrence Friedman, "Operations Research: Methods & Problems," 1stEdition, 1959.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 appropriate optimization method to solve complex problems involved in various industries.
CO2: Demonstrate the optimized material distribution schedule using transportation model to minimize total distribution cost.
CO3: Find the appropriate algorithm for allocation of resources to optimize the process of assignment.
CO4: Apply the knowledge of game theory concepts to articulate real-world competitive situations to identify strategic decisions to counter the consequences.
CO5: Develop a suitable queuing system to control important performance measures dynamically.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

Programme:UG **Class:BCA(C& CS)**	Year: I Semester: II
Credits Theory: 0 Practical: 2	**Subject:Data Structure and algorithm using C Lab**
Course Code:BCA-NEP-205P	**Title:Data Structure and algorithm using C Lab**

Course Objectives:
CO1: To Understand and Implement basic Data Structure using C
CO2: To apply Linear an Non Linear Data Structure in Problem Solving.
CO3: To Implement Searching and Sorting Algorithm.

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks

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	Basic of Data Structure Programs- Looping,Data Manipulation,array.	2
II	Program using Structures and dynamic Memory allocations.	2
III	Array Implementation of Stacks and queues	2
IV	Linked List Implementation of Stacks and Queues	2
V	Application of Stacks and Queues	2
VI	Implementation of Trees,Tree Traversals	2
VII	Implementation of Binary Search Trees	2
VIII	Implementation of Linear search and Bianry Search	2
IX	Implementation of Insertion Sort,Bubble Sort,Quick Sort and Merge Sort.	2

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	25 25
Total:	50

Course Learning Outcomes:
Student will be able to :
CO1: Write basic and advanced Program in C using Linear and Non Linear Data Structure.
CO2: Implement Data Structure using C.
CO3: Choose appropriate Sorting Algorithm for an application and implement it in a modularized way.
CO4: Linear data structures and their applications such as Stacks, Queues and Lists and Non-Linear Data Structures and their Applications such as Trees.

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UGC Approved Section 2f & 12B

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-II

<table>
<tr><td colspan="2">Programme: UG
Class: BCA(C & CS)</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td>Credits
Practical: 2</td><td colspan="3">Subject: Linux and administration lab(SPT-II)</td></tr>
<tr><td>Course Code:
BCA-NEP-212P</td><td colspan="3">Title: Linux and administration lab</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 50% Marks</td></tr>
<tr><td colspan="4">L:0
T:0
P:4 (In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
</table>

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

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: Student will be able to: CO1: To demonstrate the basic knowledge of Linux commands and file handling utilities by using Linux shell environment. CO2: To understand the concept of client-server communication by using sockets.

IIMTU-NEPIMPLEMENTATION
Year-II / Semester-III

Programme: Diploma **Class:BCA(C& CS)**	**Year:**II **Semester:**III
Credits Theory:4Cr	**Subject:** Advanced cloud security(SPT-III)
Course Code: BCA-NEP-311	**Title:**Advanced cloud security

Course Objectives:
CO1: Understand cloud security and its service providers.
CO2: Describe essential features of cloud computing.
CO3: Identify the threats and issues associated with cloud based IT services.
CO4: Compare advantages and disadvantages of various cloud computing platforms.
CO5: Identify security and privacy issues in cloud computing.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks

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	**Basic Networking:** Introduction to Networking, IP Addressing, CIDR, Protocols **Introduction to Cloud Computing**: Why Cloud Computing? What is Cloud Computing? History of Cloud Computing, Service Models, Deployment Models, Cloud Providers	10
II	**Working with Virtual Machines:** Virtual Machines Planning, Creating Virtual Machines (Windows & Linux),Virtual Machines Availability, Virtual Machines Extensions **Azure Storage:** Storage Account, Blob Storage, Azure Files ,Snapshots **Virtual Networks:** Virtual Networks (Vnet), IP Address, Azure DNS, Network Security Groups (NSG),Bastion Host	10
III	**Inter-site Connectivity:** VNet Peering, VNet to VNet Connections, Express Route, Custom Routes, Azure Load Balancer ,Azure Auto scaling (Sets),Azure Traffic Manager, Application Gateway, Azure Firewall Setup,Virtual WLAN **Application Services-** Service Plans, App Service (Web App, Mobile App, Push App), Azure SQL Server, Web Jobs, Cross Platform Application, Containers, Docker, Kubernetes	10
IV	**Azure Monitoring:** Azure Monitoring, Azure Alerts, Network Watcher **Data Protection:** Data Replication Types, Azure Data Backup,, Azure Virtual Machine Backup On-Premises backup using MARS **Azure Active Directory:** What is Azure Active Directory, Azure AD Connect, Azure AD Join, Multi Factor Authentication, Azure Identity	10

	Protection	
V	**Governance and Compliance:** Subscription and Account, Azure Users and Groups, Role Based Access Control (RBAC), Azure Policy, Azure Management Group **Data Services:** CDN (Streaming), Azure File Sync,Data Box Type	10

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.
2. Ritting house, John W., and James F. Ransome, ―Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

Reference:

1. William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010.
2. Michael T. Goodrich and Roberto Tamassia, Introduction to Computer Security, Addison Wesley, 2011.

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 core cloud computing concepts and principles.
CO2: Able to understand the differences between traditional and cloud based security methodologies.
CO3: Able to understand standard cloud security architecture models.
CO4. Able to identify security and privacy issues in cloud computing.
CO5: Able to identify various application servicer of Azure.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-III

Programme:DIPLOMA **Class:BCA(C& CS)**	**Year:**II **Semester:** III
Credits Theory:4Cr	**Subject:** Computer System Architecture
Course Code: BCA-NEP-304	**Title:** Computer System Architecture
Course Objectives: CO1: To learn the concepts regarding microprocessor with 8 bit. To learn the concepts regarding CO2: Microprocessor with 16 bit. To understand the basic idea of the internal architecture and register configuration of respective devices. CO3: To understand the programming techniques of with the help of Assembly Language Programming. CO4: To understand the basic concept of parallel computing. CO5: To understand significance of pipelining and parallelism, so that the devices used to perform	
Nature of Paper: DISCIPLINE SPECIFIC ELECTIVE	
Minimum Passing Marks/Credits: 40% Marks	
L:4 T:0 P:0(In Hours/Week) Theory - 1 Hr. = 1 Credit	

Unit	Contents	No. of Lectures Allotted
I	Basic Computer Organization and Design: Instructions and Instruction Codes, Computer Registers, Timing and Control, Instruction Cycle, Register Transfer and Micro Operations-Registration Transfer Language, Register Transfer Instructions, Bus and Memory Transfer Instructions, Arithmetic and Logic Micro-Operations, Shift Micro-Operations, Arithmetic Logic Shift Unit; Memory-Reference Instructions, Input-Output and Interrupts, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.	8
II	**Central Processing Unit:** General Register Organization, Stacks Organization, Instruction Formats, Addressing Modes, RISC, CISC, Parallel Processing, Pipelining, Instruction and Arithmetic Pipeline, Vector Processing, Matrix Multiplication, Array Processors.	8
III	**Computer Arithmetic:** Addition, Subtraction Algorithms; Multiplication Algorithms: Shift and Add Algorithms, Booth's Algorithm; Divisor Algorithms, Floating Point Representations, Arithmetic Operations on Floating-Point Numbers, Decimal Arithmetic Operations.	8
IV	**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Mode of Transfer, Priority Interrupts, Direct Memory Address (DMA), Input/ Output Processor (IOP), Serial Communication.	8
V	**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory	8

	Management Hardware.	

Text Books:

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

Reference:

1. Rao, "Prospective in Computer Architecture" , Prentice Hall of India
2. John P. Hayes, "Computer Architecture and Organization", McGraw-Hill

Evaluation/Assessment Methodology

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

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-III

<table>
<tr><td colspan="2">Programme: Diploma
Class: BCA(C& CS)</td><td>Year:II
Semester:III</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="2">Subject: Communication Skill & Personality Development</td></tr>
<tr><td>Course Code:
BCA-NEP-303</td><td colspan="2">Title: Communication Skill & Personality Development</td></tr>
<tr><td colspan="3">Course Objectives:
CO1: To understand the concept, process and importance of communication.
CO2: To develop skills of effective communication both written and oral.
CO3: To help acquaint with application of communication skills in the world of business.
CO4: To understand the concept of personality and personality development and its significance.
CO5: To understand and develop various traits required for personality development.</td></tr>
<tr><td colspan="3">Nature of Paper: AECC</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="3">L:3
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
</table>

Unit	Contents	No. of Lectures Allotted
I	**Introduction to Communication** Meaning and Definition, Process, Functions, Objectives, Importance, Essentials of Good Communication, Communication Barriers, Overcoming Communication Barriers.	8
II	**Written Communication:** Need and functions of business letters, Planning and layout of business letters, Advantages and limitations of written communication. **Oral Communication:** Meaning, nature and scope, Principles of Effective Oral Communication, Techniques of Effective Speech, The Art of Listening, Principles of Good Listening, Advantages and Limitations of Oral Communication.	8
III	**Personality Development:** The concept of personality Dimensions of personality, Term personality development, Significance. **Attitude and Motivation :** Attitude, Concept, Significance, Factors affecting attitudes, Positive attitude, Advantages, Negative attitude, Disadvantages, Ways to develop positive attitude, Difference between Personalities having Positive and Negative Attitude, Concept of motivation, Significance, Internal and external motives, Importance of self-motivation, Factors leading to demotivation.	8
IV	**Self-Esteem:** Term self-esteem, Symptoms, Advantages, Do’s and Don’ts to develop positive self-esteem, Low self-esteem, Symptoms, Personality having low self-esteem, Positive and negative self-esteem. **Interpersonal Relationships**:	8

	Interpersonal relationships, Teaming, Developing positive personality, Analysis of strengths and weaknesses.	
V	**Goal-Setting:** Concept of goal-setting, Importance of goals, Dream Vs goal, Why goal-setting fails- SMART (Specific, Measurable, Achievable, Realistic, Time-bound) goals, Art ofPrioritisation, Do's and Don'ts about goals. **Essential soft skills Assertiveness -** Lateral thinking - Work ethics, Good manners and etiquettes Concept, significance.	8

Text Books:

1. Cloninger, S.C., "Theories of Personality: Understanding Person", Pearson, New York, 2008, 5thedition.
2. Luthans F, "Organizational Behaviour", Mc. Graw Hill, New York, 2005, 12th Edition.
3. Barron, R.A. & Brian D, "Social Psychology", Prentice Hall of India, 1998, 8thedition.

Reference

1. Adler R.B., Rodman G. & Hutchinson C.C. , "Understanding Human Communication", Oxford University Press : New York, 2011.

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 35
Total:	100

Prerequisites for the course: *Problem Solving using C*

Course Learning Outcomes:

CO1: Identify different concept of Personality
CO2: Able to Compare and contrast different personal grooming pertains.
CO3: Able to explore communication beyond language.
CO4: Able to manage oneself while communicating.
CO5: Able to acquire good communication skills and develop confidence.

Format-3

IIMTU-NEPIMPLEMENTATION
Year-II / Semester-III

Programme: Diploma **Class: BCA(C& CS)**	**Year:** II **Semester:** III
Credits Theory:4Cr	**Subject:** Data Analytics
Course Code: BCA-NEP-304	**Title:** Data Analytics

Course Objectives:
CO1: Understand item sets, Clustering, frame works & Visualizations.
CO2: Apply R tool for developing and evaluating real time applications.
CO3: Implement various Data streams.
CO4: Understand and apply Data Analysis Techniques.
CO5: Describe the life cycle phases of Data Analytics through discovery, planning and building.

Nature of Paper: Discipline Specific Elective

Minimum Passing Marks/Credits:40% Marks

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

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, operation alization	8
II	**Data Analysis:** Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis oftime series: linear systems analysis & nonlinear dynamics, rule induction, Neural Networks: Learning and generalization, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	8
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 ina window, decaying window, Real-time Analytics Platform (RTAP)applications, Case studies – Real time sentiment analysis, stock market predictions.	8

IV	**Frequent Itemset 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 Pro CLUS, frequent pattern-based clustering methods, clustering in non-Euclidean space, clustering for streams and parallelism.	8
V	**Frame Works and Visualization**: Map Reduce, Hadoop, Pig, Hive, H Base, Map R, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications.	8

Text Book:

1. John Garrett, "Data Analytics for IT Networks: Developing Innovative Use Cases", Pearson Education.
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley.

Reference Book:

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

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks /Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 data gathering of large data from a range of data sources.
CO1: Able to Critically analyse existing Big Data datasets and implementations, taking practicality, and usefulness metrics into consideration.
CO3: Able to perform the role of statistics in the analysis of large of datasets.
CO4: Able to apply advanced knowledge of statistical data analytics as applied to large data sets.
CO5: Employ advanced statistical analytical skills to test assumptions, and to generate and present new information and insights from large datasets.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-III

Programme:UG **Class: BCA(C & CS)**		Year: II Semester:III
Credits Practical: 2	**Subject:Advance cloud security lab-1 (SPT-III)**	
Course Code: BCA-NEP-312P	**Title:Advance cloud security 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

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	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 wordcount.	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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	25
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:UG **Class: BCA(C & CS)**		Year: II Semester:III
Credits Theory: 0 Practical: 2	**Subject:OOPS USING JAVA LAB**	
Course Code: **BCA-NEP-305P**	**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		
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", McGraw Hill.
2. Bala Guruswamy, "Programming with Java: A Primer", Tata McGraw Hill 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	25 25
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.

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-III

Programme: Diploma **Class:BCA(C& CS)**		Year: II Semester: III
Credits Theory:4Cr	**Subject:**Object Oriented Programming Using Java	
Course Code: BCA-NEP-301	**Title:**Object Oriented Programming Using Java	

Course Objectives:

CO 1: Able to understand the use of OOPs concepts.
CO 2: Able to solve real world problems using OOP techniques.
CO 3: Able to understand the use of abstraction.
CO 4: Able to understand the use of Packages and Interface in java.
CO 5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks

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 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, Vectors, Command-Line Arguments.	12
II	Classes, Objects and Methods: Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors, Types of Constructors, this & static keyword, Garbage Collection, Inheritance, Types of Inheritance, Creating Multilevel Hierarchy, Method Over Loading & Overriding, Dynamic Method Dispatching, final keyword, Abstract Class.	12
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. Multithreaded Programming: Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority	12
IV	Managing I/O Files: Introduction, Streams, Stream Classes, File Class, Creation of Files, Reading and Writing to File, Buffering Files, Random Access Files, Interactive I/O. GUI Programming: GUI Components, AWT, Swings, Event Handling.	12

V	Introduction to Applet Programming: Introduction to Applet, Applet Architecture, Applet Life Cycle, Applet Class, Applet Tag, Applet Methods, Running the Applet. JDBC: Accessing Databases With Java Database Connectivity	12

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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO 1: Able to understand the use of OOPs concepts.
CO 2: Able to solve real world problems using OOP techniques.
CO 3: Able to understand the use of abstraction.
CO 4: Able to understand the use of Packages and Interface in java.
CO 5: Able to develop and understand exception handling, multithreaded applications with synchronization.

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-IV

Programme:DIPLOMA **Class:BCA(C& CS)**		**Year: II** **Semester: IV**
Credits Theory:4Cr	**Subject:** Advance Cloud Security-2 (SPT-IV)	
Course Code: BCA-NEP-411	**Title:** Advance Cloud Security	

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

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 Ethical Hacking:** Key issues plaguing the information security world, incident management process, and penetration testing **Footprinting and Reconnaissance:** Various types of footprinting, footprinting 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, jailbreaking 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 (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 2) Presentations /Seminar 3) Assignments	15
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 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

<table>
<tr><td colspan="2">Programme: Diploma
Class: BCA(C& CS)</td><td colspan="2">Year: III
Semester: IV</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject: Data Mining</td></tr>
<tr><td>Course Code:
BCA-NEP-404</td><td colspan="3">Title: Data Mining</td></tr>
<tr><td colspan="4">Course Objectives:
CO1: To introduce students to basic applications, concepts, and techniques of data mining.
CO2: To develop skills for using recent data mining software to solve practical problems in a variety of disciplines.
CO3: To extract knowledge from data repository for data analysis, frequent pattern, classification and prediction.
CO4: Understand and implement classical models and algorithms in data warehouses and data mining.
CO5: Master data mining techniques in various applications like social, scientific and environmental context.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">Introduction: Data Mining - Overview, Motivation, Definition & Functionalities, Major issues in Data Mining, Integration of Data Mining System with Data Warehouse System.
Data Preprocessing: Descriptive Data Summarization, Data Cleaning-Missing Values, Noisy Data, Data Integration and Transformation, Data Reduction-Data Cube Aggregation, Attribute Subset Selection, Dimensionality Reduction, Numerosity Reduction, Discretization and Concept Hierarchy.</td><td>10</td></tr>
<tr><td>II</td><td colspan="2">Association Rules: Introduction, Frequent Itemsets, Closed Item sets, Methods to Discover Association Rules, Apriori Algorithm, Multilevel Association Rule Mining, and Rule Evaluation Metrics.</td><td>10</td></tr>
<tr><td>III</td><td colspan="2">Classification and Prediction: Classification Techniques-Decision Tree, Rule-Based Classification, Bayesian Classification, k-Nearest-Neighbor Classifier, Linear Regression, Accuracy and Error Measures</td><td>10</td></tr>
<tr><td>IV</td><td colspan="2">Cluster Analysis: Introduction, Types of Data, Partitioning Methods- k-Means and k-Medoids, Hierarchical Clustering- Chameleon, Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods-Neural Network Approach, Outlier Analysis.</td><td>10</td></tr>
<tr><td>V</td><td colspan="2">Recent Trends and Applications: Web Mining, Spatial Data Mining, Text Mining, Multimedia Data Mining, Applications of data mining in finance, business, social networks.</td><td>10</td></tr>
</table>

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

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 functionality of the various data mining and data warehousing component.
CO2:	Appreciate the strengths and limitations of various data mining and data warehousing models.
CO3:	Explain the analyzing techniques of various data.
CO4:	Describe different methodologies used in data mining and data ware housing.
CO5:	Compare different approaches of data ware housing and data mining with various technologies.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-IV

Programme: Certificate/Diploma/Degree/ UG(R)/PG/Ph.D. Certificate **Class: All UG Classes of IIMT University**	Year: II Semester: IV
Credits Theory- 3Cr	**Subject: Human values and professional ethics**
Course Code Theory UVE-401	**Title: Human values and professional ethics**

Course Objectives:

CO1: To reinstate the rich cultural legacy and human values of which we are the custodians.
To focus on professional ethics which are broader indicators of desirable actions vis-à-vis
CO2: undesirable actions.
To lay down broader guidelines of values and ethics for internal and external stakeholders.
CO3: To suggest operational guidelines for value-based and ethical practices in the higher educational institutions leading to implementation and monitoring.
CO4: To indicate the outcomes of creating a value-based and ethical culture in HEIs.
CO5: CO6:To suggest indicative reinforcement programmes for nurturing human values and ethics in HEIs.

Nature of Paper: Core/DSE/SEC/GE/AECC-AECC

Minimum Passing Marks/Credits: 40% Marks

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

Unit	Contents (Theory)	No. of Lectures Allotted
I	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education	6
II	Understanding Harmony in the Human Being - Harmony in Myself	6
III	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship	6
IV	Understanding Harmony in the Nature and Existence - Whole existence as Co-existence	6
V	Implications of the above Holistic Understanding of Harmony on Professional Ethics	6

Suggested Readings: For Theory

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.

6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, ExcelBooks.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted2008.
13. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Evaluation/Assessment Methodology

	Max. Marks: 50
1) Class tasks/ Sessional Examination	10 marks
2) Presentations /Seminar	05 marks
3) Assignments	
4) Research Project Report Seminar On Research Project Report	
5) ESE	35
Total:	50

Prerequisites for the course: First year must be clear for appearing in IIIrd/IVth for the study of this Audit/Qualifying course**- for theory**

Course Learning Outcomes:

CO1: The learning process for holistic development.
CO2: Impeccable governance.
CO3: Effective institutional management.
CO4: Well laid system of rewards and chastisement.
CO5: Institutional climate where ‘rights’ enjoy and ‘wrongs’ are discouraged.

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Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-IV

Programme: Diploma **Class: BCA(C& CS)**	**Year:**II **Semester:**IV
Credits Theory:4Cr	**Subject:** Numerical Analysis
Course Code: BCA-NEP-404	**Title:** Numerical Analysis

Course Objectives:

CO1: Basic understanding of numerical Algorithms.

CO2: Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques.

CO3: Use the concepts of interpolation, eigen value problem techniques for mathematical problems arising in various fields.

CO4: Solve initial value and boundary value problems which have great significance in engineering practice using ordinary and partial differential equations.

CO5: Demonstrate elementary programming language, implementation of algorithms and computer programs to solve mathematical problems.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks

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:** Numbers representation on a computing machine with particularization to single precision, double precision, quadruple precision and the Intel 86 family of processors. Definitions of numerical rounding error and chopping error, Discussion of major sources of error in numerical analysis	8
II	**Solution of algebraic equations:** Description of : Bijection algorithm and its coding; Method of False Position and its coding; The Secant algorithm and its coding; The Newton-Raphson algorithm and its coding. Brief discussion of the robustness and relative performance of these algorithm, Properties of the fixed point algorithm xn+1 = g(xn) given x0. Definition of the Lipshitz condition and the notion of a cont raction algorithm. - Conditions for convergence of xn+1 = g(xn), Error estimation for algorithm xn+1 = g(xn),General notion of the order of an iterative algorithm, Aitken acceleration and Steffensen's algorithm, Solution of systems of algebraic equations	8
III	**Numerical Interpolation:** Polynomial interpolation, Definition of the Lagrange interpolating polynomial ,Interpolation based on the Lagrange interpolating polynomial, Newton interpolation using divided differences, Error analysis underlying polynomial interpolation based on, Rolle's theorem. - The Chebyshev Economization and its optimality, Piecewise linear spline, Subpoint quadratic spline, Construction of the cubic spline, Least-squares data fitting; its	8

	use and implementation	
IV	**Solution of linear equations:** Concept of Gaussian elimination, the concept of pivoting and a simple illustration of why pivoting is needed, LU factorization of matrices with and without partial/full pivoting, The Choleski factorization, Matrix inversion Iterative methods, The concept of a matrix norm with simple examples, e.g. the Frobenius norm ,The Jacobi iteration algorithm, The Gauss-Seidel algorithm, The Gauss-Seidel algorithm with over-relaxation	8
V	**Numerical calculation of matrix eigenvalues:** Gershgorin's theorem with an example - The Power algorithm, The Inverse Power algorithm ,The Jacobi transformation, The Householder transformation ,Construction of the Upper Hessenberg matrix, The QR algorithm	8

Text Books:

1. V. A. Patel. Numerical Analysis. Harcourt Brace, College Publishers, 1994.
2. W. Cheney and D. Kincaid. Numerical Mathematics and Computing. Brooks/Cole Publishing Company, 2003.

Reference

1. Numerical Analysis. 9th ed. R.L. Burden and J.D. Faires: Edition Brooks / cole: -73563-538-0-978 .2011136
2. An Introduction to Numerical Analysis. Endre Süli, David F. Mayers Cambridge : -0521810264 -2003 .0521007941

Evaluation/Assessment Methodology

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

Prerequisites for the course: *NIL*

Course Learning Outcomes:

CO1: Discuss robustness and relative performance of different algorithm
CO2: Able to apply interpolation methods for solving the problems numerically
CO3: Able to calculate the errors and the rates of convergence
CO4: Able to evaluate the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
CO5: Able to develop numerical algorithms for the solution of the algebraic eigen value problem.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-IV

Programme: Diploma **Class: BCA(C& CS)**	Year: II Semester: IV
Credits Theory:4Cr	**Subject:** Software Engineering
Course Code: BCA-NEP-401	**Title:** Software Engineering

Course Objectives:
CO1: Select and implement different software development process models.
CO2: Extract and analyze software requirements specifications for different projects.
CO3: Develop some basic level of software architecture/design.
CO4: Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress.
CO5: Apply different testing and debugging techniques and analyzing their effectiveness.

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks

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: 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.	10
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, Behavioral Modeling, Control Specification, Process Specification, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.	10
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 and Programming Support Environment, Quality Metrics for Design Model and Source Code.	10

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.	10
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, Configuration Audit, Metrics for Maintenance.	10

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, ChandramouliSeetharaman, B. G Geetha, “Software Engineering”, Pearson Education India

Evaluation/Assessment Methodology

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

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Select and implement different software development process models.
CO2: Extract and analyze software requirements specifications for different projects.
CO3: Develop some basic level of software architecture/design.
CO4: Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress.
CO5: Apply different testing and debugging techniques and analyzing their effectiveness.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-IV

Programme: UG **Class: BCA(C & CS)**	Year: II Semester: IV	
Credits Practical: 2	**Subject: Software Engineering Lab**	
Course Code: BCA-NEP-405P	**Title: Software Engineering Lab**	

Course Objectives:
Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement

Nature of Paper: Core

Minimum Passing Marks/Credits: 50% Marks

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	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, Design Documents and	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.	

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. KK Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.

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

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	25 25
Total:	50

Course Learning Outcomes:
Student will be able to:
CO1: Draw a class diagram after identifying classes and association among the
CO2: Graphically represent various UML diagrams , and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially
CO3: Able to use modern engineering tools for specification, design, implementation and testing
CO4: Develop test cases for various white box and black box testing techniques.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-IV

Programme:UG **Class:BCA(C & CS)**	Year: II Semester:IV
Credits Practical: 2	**Subject:Advance cloud security lab-2 (SPT-IV)**
Course Code: BCA-NEP-412P	**Title:Advance cloud security lab (SPT-IV)**

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

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	Study the use of network reconnaissance tools like WHOIS, dig, trace route, nslookup to gather information about networks and domain registrars	2
II	Implement a code to simulate buffer overflow attack.	2
III	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
IV	Detect ARP spoofing using open-source tool ARPWATCH.	2
V	Use the Nessus tool to scan the network for vulnerabilities.	2
VI	Set up IPSEC under LINUX	2
VII	Mini project	2

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:
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
1. Discover well known cyber attack incidents

Format-3

IIMTU-NEPIMPLEMENTATION
Year- III / Semester- V

Programme: Degree **Class:BCA(C& CS)**		**Year:** III **Semester:** V
Credits Theory:4Cr	**Subject:** 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: Discipline Specific Elective

Minimum Passing Marks/Credits:40% Marks

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, securityin 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 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 Info sphere, 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 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) Classtasks/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 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

NEPIMPLEMENTATION
Year-III /Semester- V

Programme: Degree **Class: BCA(C& CS)**	**Year:** III **Semester:** V	
Credits Theory:4Cr	**Subject:** 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		
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	10
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.	10
III	Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services,	10
IV	Network layer: Logical Addressing, Internetworking, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.	10
V	Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.	10

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	10
Seminar On Research Project Report	
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

<table>
<tr><td colspan="2">Programme:Degree
Class:BCA(C& CS)</td><td>Year: III
Semester: V</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="2">Subject:ERP</td></tr>
<tr><td>Course Code:
BCA-NEP-503</td><td colspan="2">Title:ERP</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td colspan="3">Nature of Paper: DSE</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="3">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
</table>

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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100

Prerequisites for the course: *nil*

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:UG **Class:BCA(C & CS)**		Year: III Semester: V	
Credits Practical: 2	**Subject:**Computer Forensics Lab (SPT- V)		
Course Code: BCA-NEP-512P	**Title:**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

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 00of 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) 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 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- VI

Programme: Degree **Class:BCA(C& CS)**	**Year:** III **Semester:**VI
Credits Theory:4Cr	**Subject:**E-Commerce
Course Code: BCA-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

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	10
Seminar On Research Project Report	
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 Theory:4Cr	**Subject:** 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

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, My SQL 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: Jail breaking/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, A Aron Walters. 2. Computer Evidence Collection &Presentation by Chrostopher L.T. Brown, Firewall Media.

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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-III /Semester- VI

Programme: Degree **Class:BCA (C& CS)**	**Year:** III **Semester:** VI
Credits Theory:4Cr	**Subject:**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

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: 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

<table>
<tr><td colspan="2">Programme: Degree
Class: BCA(C& CS)</td><td colspan="2">Year:III
Semester:VI</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject:Real Time System</td></tr>
<tr><td>Course Code:
BCA-NEP-603</td><td colspan="3">Title:Real Time System</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">REAL TIME COMMUNICATION :
Introduction – VTCSMA – PB CSMA- Deterministic collision resolution protocol-DCR for multipacket messages- dynamic planning based-Communication with periodic and aperiodic messages.</td><td>8</td></tr>
<tr><td>IV</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>V</td><td colspan="2">REAL-TIME MODELING AND CASE STUDIES :
Petri nets and applications in real-time modeling, Air traffic controller system – Distributed airdefense system.</td><td>8</td></tr>
<tr><td colspan="4">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 &</td></tr>
</table>

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 2) Presentations /Seminar 3) Assignments	15
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:UG **Class:BCA(C & CS)**	Year: III Semester: VI
Credits: Practical: 2	**Subject:**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

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

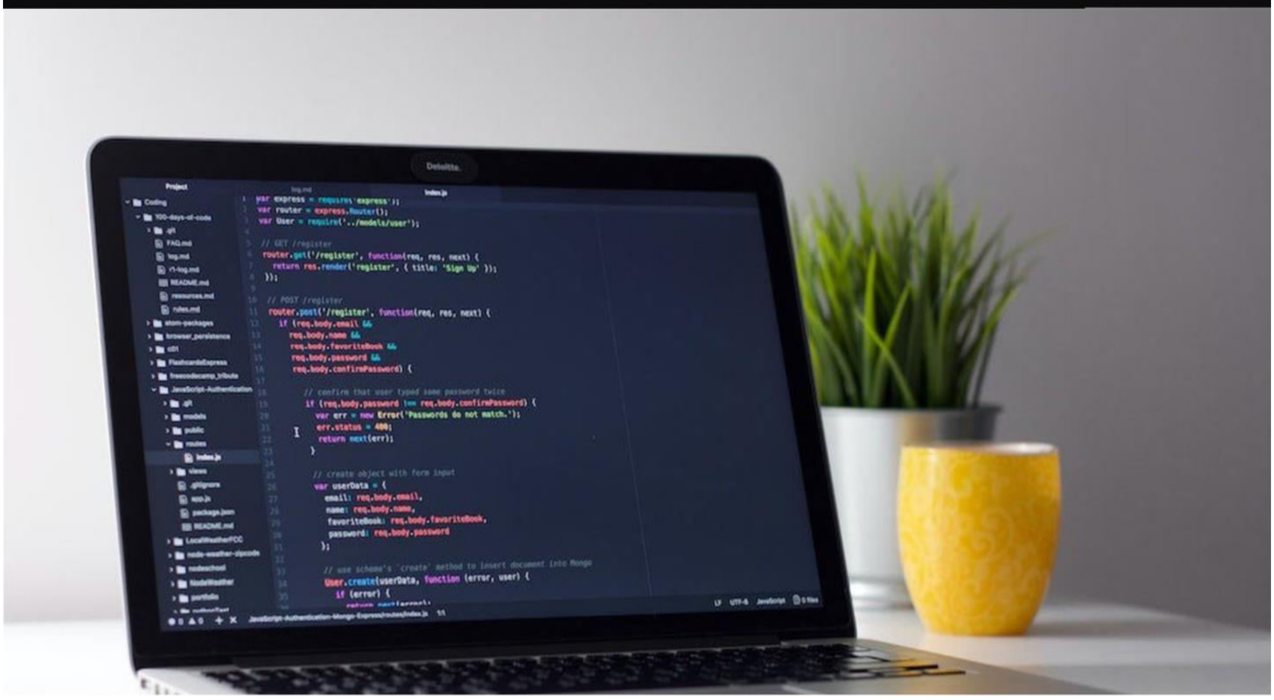
Max. Marks:50

1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments 4) 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 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.

School of Computer Science & Applications

ACADEMIC HANDBOOK



Ordinance & Academic Regulations
Bachelor of Computer Science (B.Sc.-CS)

Index

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 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 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.

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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 academicmaturity 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.-CSprogramme 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. ASSESMENT 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 – ASSESMENT 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 amaximum 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/ACEDIMIC 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 fulfilsthose 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-bailable offence in our country. The current State andCentrallegislationsprovidestringentpunishmentsincludingimprisonment.Oncetheinvolvemen tofastudent(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 thelaid 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) Semester - I											
S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme							
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	BCS-NEP-101	Problem Solving using C	C1	4	0	0	25	75	**100**	**4**
2	BCS-NEP-102	Fundamentals of Computer and IT	C2	4	0	0	25	75	**100**	**4**
3	BCS-NEP-104	1. Mathematics-I 2. Discrete Mathematics	DSE	4	0	0	25	75	**100**	**4**
4	NHU-111	English Communication	AECC	3	0	0	15	35	**50**	**3**
5	BCS-NEP-105P	Problem Solving using C Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
6	BCS-NEP-106P	Fundamentals of Computer and IT Lab	CORE LAB 2	0	0	4	25	25	**50**	**2**
		Grand Total		**15**	**0**	**8**	**140**	**310**	**450**	**19**

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: STUDENT CAN TAKE NCC (GENCC-101) AS A GENERAL ELECTIVE/OPTIONAL COURSE AND CERTIFICATE WILL BE PROVIDED AFTER COMPLETION OF NCC COURSE.

B.Sc (COMPUTER SCIENCE) Semester - II										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCS-NEP-201	Data Structure and Algorithms using C	C1	4	0	0	25	75	**100**	**4**
2	BCS-NEP-202	Digital Electronics	C2	4	0	0	25	75	**100**	**4**
3	BCS-NEP-204	1. Mathematics-II 2. Optimization Techniques	DSE	4	0	0	25	75	**100**	**4**
4	*Code will be decided by parent department	GE-I (To be opted by the students as per the given electives in the list attached)	GE (Mandatory)	4	0	0	25	75	**100**	**4**
5	NHU-112	Environmental & Ecology	AECC	3	0	0	15	35	**50**	**3**
6	BCS-NEP-205P	Data Structure and Algorithms using C	CORE LAB 1	0	0	4	25	25	**50**	**2**
7	BCS-NEP-206P	Digital Electronic Lab	CORE LAB 2	0	0	4	25	25	**50**	**2**
8	BCS-NEP-207P	MOOC	SEC	4	0	0	50	0	**50**	**4**
		Grand Total		**23**	**0**	**8**	**215**	**385**	**600**	**27**
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) Semester - III										
S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	BCS-NEP-301	OOPS using JAVA	C1	4	0	0	25	75	**100**	**4**
2	BCS-NEP-304	DBMS	C2	4	0	0	25	75	**100**	**4**
3	BCS-NEP-302	1. Computer System Architecture 2. Data Analytics	DSE	4	0	0	25	75	**100**	**4**
4	BCS-NEP-303	Communication Skill & Personality Development	AECC	3	0	0	15	35	**50**	**3**
5	BCS-NEP-305P	OOPS using JAVA Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
6	BCS-NEP-307P	DBMS Lab	CORE LAB 2	0	0	4	25	25	**50**	**2**
		Grand Total		**15**	**0**	**8**	**140**	**310**	**450**	**19**
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: STUDENT CAN TAKE NCC (GENCC-101) AS A GENERAL ELECTIVE/OPTIONAL COURSE AND CERTIFICATE WILL BE PROVIDED AFTER COMPLETION OF NCC COURSE.										

B.Sc (COMPUTER SCIENCE) Semester - IV										
S. No.	Subject Code	Subject Name	Course Type	Evaluation Scheme						
				Periods			Internal Marks	External Marks	Total Marks	Credits
				L	T	P				
1	BCS-NEP-401	Software Engineering	C1	4	0	0	25	75	**100**	**4**
2	BCS-NEP-402	Operating System	C2	4	0	0	25	75	**100**	**4**
3	BCS-NEP-404	1. Data Mining 2. Numerical Analysis	DSE	4	0	0	25	75	**100**	**4**
4	*Code will be decided by parent department	GE-II (To be opted by the students as per the given electives in the list attached)	GE-II (Mandatory)	4	0	0	25	75	**100**	**4**
5	UVE-401	Human Values and Professional Ethics	AECC	3	0	0	15	35	**50**	**3**
6	BCS-NEP-405P	Software Engineering Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
7	BCS-NEP-406P	Operating System Lab	CORE LAB 2	0	0	4	25	25	**50**	**2**
8	BCS-NEP-407P	MOOC	SEC	4	0	0	50	0	**50**	**4**
		Grand Total		**23**	**0**	**8**	**215**	**385**	**600**	**27**
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) 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-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) 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	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.

Format-1

Format-1

IIMTU-NEP IMPLEMENTATION
CBCS: Statement of Credit Distribution

College/School:SCHOOL OF COMPUTER SCINECE AND APPLICATIONSProgramme:B.Sc. [COMPUTER SCIENCE] Duration: 3 YEARS Annual/Semester: SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee)

Minimum Credit Score Required for Certificate (40)	First Year	Sem.	Core Course/ Foundation Course (Th. 4 Cr.)	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP)/ Internship/ Industrial Project	Prerequisite
CERTIFICATE	First Year Credit (46)	I	Problem Solving using C (Th. 4 Cr.+ P 2Cr.) Fundamentals of Computers and IT (Th. 4 Cr.+ P 2Cr.)	English Communication(Th. 3Cr.)		1. Mathematics 2. Discrete Mathematics (Th. 4 Cr.)			
		II	Data Structure Algorithms using C (Th. 4 Cr. + P 2Cr.) Digital Electronics (Th. 4 Cr. + P 2Cr.)	Environment &Ecology (Th. 3 Cr)	MOOCS/NPTEL 4 Cr.	1. Mathematics II 2. Optimization Techniques (Th. 4 Cr.)	GE-I (Mandatory) (Th. 4 Cr.)		Problem Solving using C Mathematics I

Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.

College/School:SCHOOL OF COMPUTER SCINECE AND APPLICATIONSProgramme: B.Sc. [COMPUTER SCIENCE] Duration: 3 YEARS Annual/Semester - SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee) Provision to change the stream onwards

Minimum Credit Score Required for Diploma (80)	Second Year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP) /Industrial Internship /Industrial Project	Prerequisite
DIPLOMA	Second Year Credit 46	III	OOPS using JAVA (Th. 4 Cr.+ P 2Cr.) DBMS (Th. 4 Cr.+ P 2Cr.)	Communication Skill & Personality Development (Th. 3 Cr.)	.	1. Computer System Architecture 2. Data Analytics (Th. 4 Cr)			
		IV	Software Engineering (Th. 4 Cr. + P 2Cr.) OPERATING SYSTEM (Th. 4 Cr. + P 2Cr.)	Human Values and Professional Ethics (Th. 3 Cr.)	MOOCS/NPTEL 4 Cr.	1. Data Mining 2. Numerical Analysis (Th. 4 Cr.)	GE-II (Mandatory) 4 Cr.		DBMS

Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.

College/School:SCHOOL OF COMPUTER SCINECE AND APPLICATIONSProgramme: B.Sc. [COMPUTER SCIENCE] Duration: 3 YEARS Annual/Semester - SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee) Provision to change the Core Papers (Main Subject)

Minimum Credit Score Required for Degree (120)	Third Year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP) /Industrial Internship /Industrial Project	Prerequisite
DEGREE	Third Year Credit 50	V	Computer Graphics (Th. 4 Cr. + P 2Cr.) Python Programming (Th. 4 Cr. + P 2Cr.)			1. Data Communication Network 2. ERP 3. BIG Data (Th. 4 Cr.)		RP-I (AUDIT) Non-Credit Research Project-I Internship (5 Cr.)	Data Structure Algorithms using C
		VI	Cyber Security (Th. 4 Cr. + P 2Cr.) Artificial Intelligence (Th. 4 Cr. + P 2Cr.)		MOOCS/NPTEL 4 Cr.	1. Mobile Computing 2. E-Commerce 3. Real Time System (Th. 4 Cr.)	GE 3 (Mandatory) (Th. 4 Cr.)	RP-II (AUDIT) Non-Credit Research Project-II Industrial Project (5 Cr.)	

Format-2

Format-2

IIMTU-NEP Implementation:B.Sc. (Computer Science)

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(46 Cr.)**	**SEMESTER -I (19 Cr.)**	i) C1 (Th. 4 Cr. + P 2 Cr.) ii) AECC-I iii) DSE-I	4 2 3 4	4 4 3 4	45 10 40 45	Problem Solving using C Problem Solving using C lab English Communication 1. Mathematics-I 2. Discrete Mathematics	5 5 5		
			ii) C2(Th.4 Cr.+P 2Cr)	4 2	4 4	45 10	Fundamentals of Computers &IT Fundamentals of Computers & IT Lab	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 – II(27 Cr.)	i) C3 (Th. 4 Cr. + P 2 Cr.) ii) AECC-II iii) SEC-I & II iv) DSE-II v)GE-I	4 2 3 4 4 4	4 4 3 4 4 4	45 10 40 40 45 45	Data Structure Algorithms using C Data Structure Algorithms using C Lab Environment&Ecology MOOCS (NPTEL) 1. Mathematics-II 2. Optimization Techniques #To be selected from other School	5 5 5 5 5		
			ii) C4 (Th.4Cr.+P 2 Cr.)	4 2	4 4	45 10	Digital Electronics Digital Electronics Lab	5		

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: 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 newtrends in database management system.

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(46 Cr.)	SEMESTER –III(19 Cr.)	i) C5 (Th. 4 Cr. +	4	4	45	OOPS using Java	5		
			P 2 Cr.)	2	4	10	OOPS using Java Lab			
			ii) AECC-III	3	3	40	Communication Skill & Personality Development	5		
			iii) DSE-III	4	4	45	1. Computer System Architecture 2. Data Analytics	5		
			i) C6 (Th. 4 Cr. +	4	4	45	Database Management System	5		
			P 2 Cr.)	2	4	10	Database Management System Lab			
			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(27 Cr.)	i) C7 (Th. 4 Cr. +	4	4	45	Software Engineering	5		
			P 2 Cr.)	2	4	10	Software Engineering Lab			
			ii) AECC-IV	3	3	40	Human values and Professional	5		
			iii) SEC-III& IV	4	4	40	Ethics	5		
			iv) DSE-IV	4	4	45	MOOCS (NPTEL) 1. Data Mining	5		
			v) GE-II	4	4	45	2. Numerical Analysis #To be opted from otherSchool	5		
			ii) C8 (Th. 4 Cr. +	4	4	45	Operating System	5		
			P 2 Cr.)	2	4	10	Operating System Lab			

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 (50 Cr.)	SEMESTER –V (21 Cr.)	i) C9 (Th. 4 Cr. + P 2 Cr.) ii) DSE-V	4 2 4	4 4 4	45 10 45	Computer Graphics Computer Graphics Lab 1. Data Communication Network 2. ERP 3. BIG Data	5 5		
			ii) C10 (Th. 4 Cr. +P 2 Cr.)	4 2	4 4	45 10	Python Programming Python Programming Lab	5		
			iii) Research Project iv) Internship (Mandatory)	NC 5	5	10	Internship			
		SEMESTER –VI (29 Cr.)	i) C11 (Th. 4 Cr. + P 2 Cr.) ii) SEC-V & VI iii) DSE-VI iv) GE-III	4 2 4 4 4	4 4 4 4 4	45 10 40 45 45	Cyber Security Cyber Security Lab MOOCS (NPTEL) 1.Mobile Computing 2. E-Commerce 3. Real Time System #To be opted from another School	5 5 5 5		
			ii) C12 (Th. 4 Cr. + P 2Cr.)	4 2	4 4	45 10	Artificial Intelligence Artificial Intelligence Lab	5		
			iii) Research Project iv) Industrial Project (Mandatory)	NC 5	5	10	Industrial Project			

Format-3

Format-3

IIMTU-NEPIMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class:**BSC CS	**Year: I** **Semester: I**
Credits Theory:4Cr	**Subject:** Discrete Mathematics
Course Code: BCS-NEP-104	**Title:** Discrete Mathematics

CourseObjectives:

- CO1: Identify and prove properties of Algebraic Structures like Groups, Rings and Fields.
- CO2: Formulate and solve recurrences and recursive functions.
- CO3: Apply the concept of combinatorics to solve basic problems in discrete mathematics.
- CO4: Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions.
- CO5: Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic.

Nature of Paper: DSE

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

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

Unit	Contents	No. ofLectures Allotted
I	**Set Theory:** Introduction, Size of sets and Cardinals, Venn diagrams, Combination of sets, Multi sets, ordered pairs and Set Identities. **Functions:** Definition, Types of functions, Operations on functions, recursively defined functions. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation.	8
II	**Posets, Hasse Diagram and Lattices:** Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction on flattices, Properties of lattices–Bounded, Complemented, Modular and Completelattice. **Boolean Algebra:** Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean functions, Karnaugh maps, Logic gates.	8
III	**Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic. **Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection.	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 groups, Homomorphism and Isomorphism of groups.	8

	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 Nonzero 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 Pigeonhole principle, Polya's Counting theorem.	8

Text Book:

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 Book:

1. R.P. Grimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley, 2004.
2. Y.N. Singh, "Discrete Mathematical Structures", Wiley-India, First edition, 2010.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 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.

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-I

Programme: Certificate **Class:**BSC (CS)	**Year:** I **Semester: I**
Credits Theory:4Cr	**Subject:**Mathematics-I
Course Code: BCS-NEP-104	**Title:**Mathematics-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, Methods of Integration Substitution.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (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, Definite Integral, Simple Problems of Line	8

	Integral.	

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

Reference
1. Erwin Klessig, "*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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
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, 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.

IIMTU-NEPIMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class:** BSC(CS)	Year: I Semester: I
Credits Theory: 3Cr	**Subject:** English communication
Course Code: NHU-111	**Title:** English Communication

Course Objectives:

CO1: It aims to improve English communication skills i.e., Listening, speaking, reading, & writing.
CO2: To develop potential skills to deal confidently in English with diverse situations in the external world.
CO3: To work in a collaborative manner & communicate effectively in English.
CO4: To get exposure to various activities related to English Communication which will enable the learners to take initiative, solve problems, and demonstrate a positive work ethics.

Nature of Paper: AECC

Minimum Passing Marks/Credits: 40% Marks

L: 3
T: 0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents	No. of Lectures Allotted
I	English Communication skills: • listening skills, • speaking skills, • reading skills, • Writing skills. • Starting and sustaining a conversation. Process of Communication, Essential of effective Communication, Barriers to Communication, Role of Communication	8
II	Public Speech, Delivering skills, Group discussion, Communication in seminars, Conferences and Committees Parts of Speech- Noun, Pronoun, Adjective, Verb, Adverb, Conjunction, Preposition, Interjection, Articles, Common errors in English	8
III	Presentation: Features, Styles, Use of visual aids, Creating a Dynamic Presentation, Presentation and interaction, Telephonic conversation & Basic Etiquette. Non-Verbal Communication: Meaning, Types and Importance. Listening: Difference between Listening and Hearing	8
IV	Word Skills-Synonyms, Antonyms, Words often Confused, Idioms, Phrases, Phrasal Verbs	8
V	Drafting of Notices, Agendas, Minutes, Job Application letter, CV, Business Correspondence, Essentials of Effective Business Correspondence, Types and Structure of Business Letter.	8

Text Books:

- English Grammar and Composition by Wren & Martin
- Effective Communication and Soft Skills by Nitin Bhatnagar
- The ACE of Soft Skills: Attitude, Communication and Etiquette for Success by Gopalaswamy Ramesh and Mahadevan Ramesh.

Reference

- English Grammar in Use by Raymond Murphy
- English Grammar Composition and Usage by J.C. Nesfield

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination 2) Presentations /Seminar/Attendance 3) Assignments/TA	15
4) Research Project Report 5) Seminar On Research Project Report	Nil
6) ESE	35
Total:	50

Prerequisites for the course: Nil

Course Learning Outcome

CO1: To get knowledge about communication skills.
CO2: To understand about use of grammar.
CO3: To understand about presentation.
CO4: To get information about how to face interview and public.
CO5: To get knowledge about telephonic conversation & etiquette.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class:**BSC(CS)	Year: I Semester: I
Credits Theory:4Cr	**Subject:** Fundamentals of Computers and IT
Course Code: BCS-NEP-102	**Title:** Fundamentals of Computers and IT

Course Objectives:

CO 1: Demonstrate the use of mathematical software and solve simple mathematical problems.
CO 2: Explain the needs of hardware and software required for a computation task.
CO 3: State typical provisions of cyber law that govern the proper usage of Internet and computing resources.
CO 4: Explain the working of important application software and their use to perform any engineering activity.
CO 5: Demonstrate the use of Operating system commands and shell script.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks (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 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, HD, Pen drive), Input and Output Devices	8
II	**Number Systems:** Introduction to Binary, Octal, Decimal, Hexadecimal Number Systems, Conversion, Simple Addition, Subtraction, Multiplication and division. **Algorithm and Flowcharts:** Definition, Characteristics, Advantages and Disadvantages, Symbols of Flow Chart.	8
III	**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, Batch Files. Windows - History, Icons, Files and Folders, Control Panel, Task Bar, Desktop.	8
IV	**Office Tools:** Basic Concepts, Uses. **Word:** Menu Bar, Menus, Submenus, Tool Bar, Tools, Customizing Toolbar, Hiding Toolbar, Creating and Saving Documents, working with an Existing Document, Auto Text, Auto Complete and Auto Correct; Formatting a Document, Word Art, Using Tables and Columns-Table Creation and Modification Giving Stress to Auto-Fit, Auto-Format; Object Linking and Embedding, Inserting and Sizing Graphics, Hyperlink, Envelopes & Label	8

	Creation, Grammar & Spell Check, Previewing and Printing Documents, Mail Merge. **Excel:** Creating a Simple Spreadsheet, editing a Spreadsheet, Working with Functions and Formula, Formatting Worksheets, Creating Charts, Inserting and Formatting Data in a Worksheet, working with an Existing Data List, Auto Fill, Fill Series and Auto- complete Options, Formatting Cells; Sorting & Filtering Data, Conditional Formatting, Interlinking Worksheets and Files, Setting Filters and Performing Calculations on Filtered Data etc.	
V	**Power Point:** Creating and Viewing Presentations, editing a Presentation, Editing Master Slides, Inserting, Sorting, Hiding and Deleting Slides, Inserting Pictures, Creating Tables, Slide Layouts, Adding Transition and Animation Effect, Hyper Linking Slides & Files. **Internet and its Applications:** Introduction, Usage, Browser, Websites, Protocol, Domain Name, IP addresses-Mail, TELNET, FTP, World Wide Web, Portal, Blogging, E-Learning and wiki, Social Networking	8

Text Books:
1. P.K. Sinha, "*Fundamental of Computers",* BPB Publications.
2. Stephen W. Sagman & Gail Taylor,"*MS-Office 2000 For Windows*", Peach pit Press.

Reference:
1. V.Rajaraman, "*Fundamental of Computers*", Prentice-Hall of India.

Evaluation/Assessment Methodology

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

Prerequisites for the course:NIL

Course Learning Outcomes:

CO 1: Demonstrate the use of mathematical software and solve simple mathematical problems.

CO 2: Explain the needs of hardware and software required for a computation task.

CO 3: State typical provisions of cyber law that govern the proper usage of Internet and computing resources.

CO 4: Explain the working of important application software and their use to perform any engineering activity.

CO 5: Demonstrate the use of Operating system commands and shell script.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class:**BSC(CS)		**Year: I** **Semester: I**
Credits **Practical**: 2Cr	**Subject:Fundamental of Computer and IT LAB**	
Course Code: BCS-NEP-106P	**Title:Fundamental of Computer and IT LAB**	
Course Objectives: CO1: Understand Computer Fundamentals – hardware and Software CO2: Understand computer networks CO3: Study Office automation tools CO4: Email and search engines		
Nature of Paper: Core		
Minimum Passing Marks/Credits:40% Marks		
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	Identify the internal and external hardware/peripheral components	2
II	Identify the internal and external hardware/peripheral components	2
III	Prepare and print Bio-data with a covering letter using word processor.	2
IV	Calculation of Total mark, grade based on boundary conditions for n number of students using Spread sheet.	2
V	Preparation of presentation (with transition and animations, insertion of scanned images and internet contents)	2
VI	Email id creation, sending and receiving of email with attachments.	2
VII	Demonstrate how to create email-id and uploading and downloading files.	2
VIII	Identify various operating system file management commands (create, copy, move, delete and rename folders and files)	2

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:
Student will be able to:
CO1: Converse in basic computer terminology
CO2: Formulate opinions about the impact of computers on society
CO3: Possess the knowledge of basic hardware peripherals

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Programme: Certificate **Class:** BSC(CS)	Year: I Semester: I
Credits Theory:4Cr	**Subject:** Problem Solving using C
Course Code: BCS-NEP-101	**Title:** Problem Solving using C

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 concept of Arrays, Pointers, Functions, categories of function and recursion.
CO4: Students will be able to develop 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: 40% Marks (ISE +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 to 'C' Language:** History, C Character Set, Tokens, Keywords, Constants, Identifiers, Variables, Data Types, Comments, Structures of 'C' Program, Introduction to Pre-processor Directives: #include, #define, printf (), scanf (), Declaration, Assignment, Operators, Expressions, Statements, Arithmetic Expressions.	**8**
II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, Ternary Operator, got Statement, loops (for, while, do-while) in C, break and continue Statements, Nested Loops.	10
III	**Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data from Array, Using Arrays with Functions, Multi-Dimensional Arrays. **Pointers:** Basics, Pointer and Function, Array of Pointers. **Storage Classes:** Automatic, External, Static & Register. **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.	10
IV	**String:** Declaring, Initializing, String Manipulation Functions, String Input and Output Functions, String Pointer, Array of Strings, Passing String to Function. **Structure and Union:** Basic of Structures, Structures and Functions, Array	9

	of Structures, Pointer to Structure, Union.	
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: fetch (), put(), puts(), frets(), printf(), fscanf(), fwrite(), fread(), fseek(), ftell(), feof( ), etc.	8

Text Books:

1. E. Balaguruswamy, "*Programming in ANSI C",* Tata McGraw-Hill Education.
2. YashwantKanetkar, *"Let us C",* BPB Publications

Reference

1. V Rajaraman, "*Computer Basics and C Programming*", PHI Learning
2. Ashok N. Kamthane, "*Programming in C*", Pearson Education.

Evaluation/Assessment Methodology

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

Prerequisites for the course: NIL

Learning Outcomes:

CO 1:	Students will be able to develop programs based on fundamental concepts of programming in C.
CO 2:	Students will be able to solve problems based on Conditional and Iterative Control Statements.
CO 3:	Students will be able to learn Complete Programming Concepts of Arrays, Pointers and get familiar with modular programming Concepts of C using Functions.
CO 4:	Students will be able to learn conceptual programming with String, Structure and its differentiation with Union.
CO 5:	Students will be able to perform File handling programs with read and write concepts.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Program: Certificate **Class:**B.SC.(CS)		Year: I Semester: I
Credits Practical: 2Cr	**Subject:**Problem-Solving using C Lab	
Course Code: BCS-NEP-105P	**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:40% Marks

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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	25 25
Total:	50
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.	

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-II

<table>
<tr><td colspan="2">Programme: Certificate
Class:B.SC. (CS)</td><td>Year: I
Semester: II</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="2">Subject:Data Structure Algorithms using C</td></tr>
<tr><td>Course Code:
BCS-NEP-201</td><td colspan="2">Title:Data Structure Algorithms using C</td></tr>
<tr><td colspan="3">Course Objectives:
CO1: Demonstrate familiarity with major algorithms and data structures.
CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.
CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.
CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and use various data structures effectively in application programs.
CO5: Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.</td></tr>
<tr><td colspan="3">Nature of Paper: Core</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks (ISE +ESE)</td></tr>
<tr><td colspan="3">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
</table>

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, Deques, 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. 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

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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: Demonstrate familiarity with major algorithms and data structures.

CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.

CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.

CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and use various data structures effectively in application programs.

CO5: Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

IIMTU-NEPIMPLEMENTATION
Year-I/ Semester-II

Programme: Certificate **Class:** B.Sc.(CS)		**Year:** I **Semester:** II
Credits Theory:4Cr	**Subject:** Digital Electronic	
Course Code: BCS-NEP-202	**Title:** Digital Electronic	

Course Objectives:
CO1: To know the concepts of combinational circuits.
CO2: To understand Boolean algebra and minimization techniques.
CO3: Able to understand sequential circuits.
CO4: Able to understand computer buses and input/output peripherals.
CO5: To know the concepts of logic gates.

Nature of Paper: Core Course

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

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

Unit	Contents	No. of Lectures Allotted
I	**Data Representation:** Number System: Binary, Octal, Decimal, Hexadecimal; Data Representation for Computation; r's and r-1's Complement, Uses of Complement, Arithmetic Operation on Binary Numbers, Decimal Representation in Computers: BCD, Gray codes and Excess-3 codes; Alphanumeric Representation, Error-Detection and Correction Codes	10
II	**Logic Gates and Circuits:** Gates, Boolean Algebra, Laws of Boolean Algebra, Demorgan's Theorems, Minterms, Maxterms, SOP Form and POS Form, Standard and Canonical Form, Conversion of SOP/POS Expression to its Standard SOP/POS Form, Simplifications of Logic Equations Using Laws of Boolean Algebra and Karnaugh Map, Universal Gates, Implementation of Logic Circuit, Logic Circuit Implementation using NAND and NOR Gates.	10
III	**Combinational Circuits:** Definition, Design of Combinational Circuits, Adder, Subtract or, Comparator, Decoder, Encoder, Code Convertor, Multiplexer, Demultiplexer, Parity Bit Checker and Generators, Parallel Binary Adder/Subtractor, Read Only Memory and Programmable Logic Array.	10
IV	**Sequential Circuits I:** Definition, Flip-Flops, Latch, Race Around Condition, RS Flip-flop using NAND/NOR Gates, Clocked RS, JK Flip-flop, D Flip-flop, T Flip-flop, Excitation Tables, Master Slave Flip-Flop, Edge Triggered Flip-Flop, Conversion of Flip-Flops, Sequential Circuit Design.	10

Text Books:
1. Morris Mano, "*Digital Logic and Computer Design*", PHI.
2. Morris Mano, "*Computer Architecture*", PHI.

Reference
1. R.P.Jain, "*Modern Digital Electronics*", Tata McGraw Hill.
2. Malvino and Leach, "*Digital Principles and Application*", Tata Mc. Graw Hill.
3. A. Anand Kumar, "*Switching Theory and Logic Design*", PHI.

Evaluation/Assessment Methodology

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

Prerequisites for the course: Core

Course Learning Outcomes:

CO1: Able to understand and design small signal amplifier circuit.
CO2: Able to understand and analyze combinational and sequential circuits.
CO3: Able to understand logic gates.
CO4: Able to understand Boolean algebra and to minimize combinational functions.
CO5: Able to apply techniques for the design of digital circuits.

Format-3

IIMTU-NEPIMPLEMENTATION
Year-I/ Semester-II

<table>
<tr><td colspan="2">Programme: Certificate
Class:BSC(CS)</td><td colspan="2">Year:I
Semester: II</td></tr>
<tr><td>Credits
Theory:3Cr</td><td colspan="3">Subject: Environment and Ecology</td></tr>
<tr><td>Course Code:
NHU-112</td><td colspan="3">Title: Environment and Ecology</td></tr>
<tr><td colspan="4">Course Objectives:
CO1: Creating the awareness about environmental problems among people.
CO2: Imparting basic knowledge about the environment and its allied problems.
CO3: Developing an attitude of concern for the environment.
CO4: Motivating public to participate in environment protection and environment improvement.
CO5: Grasp the significance and issues related to ecosystems, biodiversity and natural resources.</td></tr>
<tr><td colspan="4">Nature of Paper: AECC</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">The Multidisciplinary Nature of Environmental Studies:
Definition, Scope and Importance, Need for Public Awareness.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">Natural Resources: Renewable And Non-Renewable Resources;
Natural Resources and Associated Problems: -
A. Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies. Timber Extraction, Mining, Dams and Their Effects on Forests and Tribal People.
B. Water Resources: Use and Over-Utilization of Surface and Ground Water, Floods, Drought, Conflicts Over Water, Dams-Benefits and Problems.
C. Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies.
D. Food Resources: World Food Problems, Changes Caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies.
E. Energy Resources: Growing Energy Needs, Renewable and Non-renewable Energy Sources, Use of Alternate Energy Sources, Case Studies
F. Land Resources: Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification.
G. Role of an Individual in Conservation of Natural Resources; Equitable Use of Resources for Sustainable Lifestyles</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">Ecosystems:
Concept of an Ecosystem; Structure and Function of an Ecosystem;</td><td>8</td></tr>
</table>

	Producers, Consumers and Decomposers; Energy Flow in the Ecosystem; Ecological Succession; Food Chains, Food Webs and Ecological Pyramids; Introduction, Types, Characteristic Features, Structure and Function of the Following Ecosystem: - A. Forest Ecosystem B. Grassland Ecosystem C. Desert Ecosystem D. Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries)	
IV	**Biodiversity and Its Conservation:** Introduction – Definition: Genetic, Species and Ecosystem Diversity; Bio geographical Classification of India; Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, and Aesthetic and Option Values; Biodiversity at Global, National and Local Levels; India as a Mega-Diversity Nation; Hot-Sports of Biodiversity; Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts; Endangered and Endemic Species of India; Conservation of Biodiversity: In-Situ and Ex-Situ Conservation of Biodiversity.	8
V	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Pollution; Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes; Role of an Individual in Prevention of Pollution; Pollution Case Studies; Disaster Management: Floods, Earthquake, Cyclone and Landslides.	8

Text Books:
1. A. Basak, "*Environmental Studies",* Pearson Education.
2. Anil Kumar De, "*Environmental Studies*", New Age International

Reference:
1. J. P. Sharma, "*Environmental Studies*", University Science Press.

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/Sessional Examination 2) Presentations /Seminar 3) Assignments 4) ResearchProjectReport SeminarOnResearchProjectReport	15
5) ESE	35
Total:	50

Prerequisites for the course: nil

Course Learning Outcomes:

CO1: Student will be able to recognize the physical and biological components of earth's system.
CO2: Student will be able to examine all environmental issues.
CO3: Student will be able to do independent research on human interaction with the environment.
CO4: Student will be able to develop and attitude of concern for the environment.
CO5: Student will be able to motivate public to participate in environmental protection.

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-II

Programme: Certificate **Class:**B.Sc. (CS)	**Year:** I **Semester:** II
Credits Theory:4Cr	**Subject:** Optimization Techniques
Course Code: BCS-NEP-204	**Title:** Optimization Techniques

Course Objectives:

CO1: Enumerate the fundamental knowledge of Linear Programming and DynamicProgramming problems.

CO2: Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function).

CO3: The problem formulation by using linear, dynamic programming, game theory and queuing models.

CO4: The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.

CO5: Formulation of mathematical models for quantitative analysis of managerial problems in industry.

Nature of Paper: DSE

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

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

Unit	Contents	No. of Lectures Allotted
I	**LINEAR PROGRAMMING (L.P):** Revised Simplex Method, Dual simplex Method, Sensitivity Analysis **DYNAMIC PROGRAMMING (D.P):** Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.	8
II	**CLASSICAL OPTIMIZATION TECHNIQUES:** Single variable optimization without constraints, Multi variable optimization without constraints, multivariable optimization with constraints –method of Lagrange multipliers, Kuhn-Tucker conditions. **NUMERICAL METHODS FOR OPTIMIZATION:** Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.	8
III	**MODERN METHODS OF OPTIMIZATION:** **GENETIC ALGORITHM (GA):** Differences and similarities between conventional and evolutionary algorithms, working principle, Genetic Operators- reproduction, crossover, mutation **GENETIC PROGRAMMING (GP):** Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, Random population generation. Fuzzy Systems: Fuzzy set Theory, Optimization of Fuzzy systems	8

IV	**QUEUING THEORY** Queuing Model, poison and exponential distributions -Queues with combined arrivals and departures-random and series queues.	8
V	**INTEGER PROGRAMMING:** Graphical Representation, Gomory's Cutting Plane Method, Balas' Algorithm for Zero–One Programming, Branch-and-Bound Method. **APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS:** Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.	8

Text Books:

1. J. K. Sharma, "Operations Research", Macmillan, 5th Edition, 2012.
2. R. Pannerselvan, "Operations Research", 2nd Edition, PHI Publications, 2006.

Reference

1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2013.
2. Maurice Saseini, ArhurYaspan, Lawrence Friedman, "Operations Research: Methods & Problems",1st Edition, 1959.

Evaluation/Assessment Methodology

Max. Marks 100

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

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Identify appropriate optimization method to solve complex problems involved in various industries.

CO2: Demonstrate the optimized material distribution schedule using transportation model to minimize total distribution cost.

CO3: Find the appropriate algorithm for allocation of resources to optimize the process of assignment.

CO4: Apply the knowledge of game theory concepts to articulate real-world competitive situations to identify strategic decisions to counter the consequences.

CO5: Develop a suitable queuing system to control important performance measures dynamically.

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-II

Programme: Certificate **Class:**B.SC. (CS)	**Year:** I **Semester:** II
Credits Theory: 4Cr	**Subject:**Mathematics-II
Course Code: BCS-NEP-204	**Title:**Mathematics-II

Course Objectives:
CO 1: Apply mathematical concepts and principles to perform computations.
CO 2: Apply mathematics to solve problems.
CO 3: Create, use and analyse graphical representations of mathematical relationships.
CO 4: Communicate mathematical knowledge and understanding.
CO 5: Apply technology tools to solve problems.

Nature of Paper: DSE

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

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

Unit	Contents	No. of Lectures Allotted
I	**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
II	**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
III	**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
IV	**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	8
V	**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 heat conduction equations, Laplace equation in two-dimension, Equation of transmission lines.	8

Text Books:
1. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley& Sons
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw- Hill Publishing Company Ltd
3. R.K.Jain&S.R.K.Iyengar, "Advance Engineering Mathematics", Narosa Publishing House.

Reference:
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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100

Prerequisites for the course: Mathematics-I

Course Learning Outcomes:

CO 1: Apply mathematical concepts and principles to perform computations.
CO 2: Apply mathematics to solve problems.
CO 3: Create, use and analyse graphical representations of mathematical relationships.
CO 4: Communicate mathematical knowledge and understanding.
CO 5: Apply technology tools to solve problems.

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-II

Programme: Certificate **Class:**B.SC. (CS)	Year: I Semester: II
Credits Practical: 2Cr	**Subject:**Data Structure and algorithm using C Lab
Course Code: **BCS-NEP-205P**	**Title:**Data Structure and algorithm using C Lab

Course Objectives:
CO1: To Understand and Implement basic Data Structure using C
CO2: To apply Linear and Non-Linear Data Structure in Problem Solving.
CO3: To Implement Searching and Sorting Algorithm.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks

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	Basic of Data Structure Programs- Looping, DataManipulation, array.	2
II	Program using Structures and dynamic Memory allocations.	2
III	Array Implementation of Stacks and queues	2
IV	Linked List Implementation of Stacks and Queues	2
V	Application of Stacks and Queues	2
VI	Implementation of Trees, Tree Traversals	2
VII	Implementation of Binary Search Trees	2
VIII	Implementation of Linear search and Binary Search	2
IX	Implementation of Insertion Sort, BubbleSort, Quick Sort and Merge Sort.	2

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	25 25
Total:	50

Course Learning Outcomes:
Student will be able to:
CO1: Write basic and advanced Program in C using Linear and Non-Linear Data Structure.
CO2: Implement Data Structure using C.
CO3: Choose appropriate Sorting Algorithm for an application and implement it in a modularized way.
CO4: Linear data structures and their applications such as Stacks, Queues and Listsand Non-Linear Data Structures and their Applications such as Trees.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-II

<table>
<tr><td colspan="2">Programme:UG
Class:B.Sc. (Computer Science)</td><td>Year:I
Semester:II</td></tr>
<tr><td>Credits
Practical: 2Cr</td><td colspan="2">Subject:Digital ElectronicsLab</td></tr>
<tr><td>Course Code:
BCS-NEP-206P</td><td colspan="2">Title:Digital ElectronicsLab</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td colspan="3">Nature of Paper: Core</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="3">L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=2Credits)</td></tr>
</table>

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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	25 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-II/ Semester-III

Programme: Diploma **Class:**BSC(CS)		Year: II Semester:III
Credits Theory:4Cr	**Subject:**Object Oriented Programming Using Java	
Course Code: BCS-NEP-301	**Title:**Object Oriented Programming 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 (ISE +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 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, Vectors, Command-Line Arguments.	12
II	Classes, Objects and Methods: Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors, Types of Constructors, this & static keyword, Garbage Collection, Inheritance, Types of Inheritance, Creating Multilevel Hierarchy, Method Over Loading & Overriding, Dynamic Method Dispatching, final keyword, Abstract Class.	12
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. Multithreaded Programming: Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority.	12
IV	Managing I/O Files: Introduction, Streams, Stream Classes, File Class, Creation of Files, Reading and Writing to File, Buffering Files, Random Access Files, Interactive I/O. GUI Programming: GUI Components, AWT, Swings, Event Handling.	12

V	Introduction to Applet Programming: Introduction to Applet, Applet Architecture, Applet Life Cycle, Applet Class, Applet Tag, Applet Methods, Running the Applet. JDBC: Accessing Databases with Java Database Connectivity	12

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:

CO 1: Able to understand the use of OOPs concepts.
CO 2: Able to solve real world problems using OOP techniques.
CO 3: Able to understand the use of abstraction.
CO 4: Able to understand the use of Packages and Interface in java.
CO 5: Able to develop and understand exception handling, multithreaded applications with synchronization.

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-III

Programme: Diploma **Class:**B.Sc. (CS)		**Year:**II **Semester:**III
Credits Theory:4Cr	**Subject:**Communication Skill & Personality Development	
Course Code: BCS-NEP-303	**Title:**Communication Skill & Personality Development	
Course Objectives: CO1: To understand the concept, process and importance of communication. CO2: To develop skills of effective communication both written and oral. CO3: To help acquaint with application of communication skills in the world of business. CO4: To understand the concept of personality and personality development and its significance. CO5: To understand and develop various traits required for personality development.		
Nature of Paper: AECC		
Minimum Passing Marks/Credits:40% Marks (ISE +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 Communication** Meaning and Definition, Process, Functions, Objectives, Importance, Essentials of Good Communication, Communication Barriers, Overcoming Communication Barriers.	8
II	**Written Communication:** Need and functions of business letters, Planning and layout of business letters, Advantages and limitations of written communication. **Oral Communication:** Meaning, nature and scope, Principles of Effective Oral Communication, Techniques of Effective Speech, The Art of Listening, Principles of Good Listening, Advantages and Limitations of Oral Communication.	8
III	**Personality Development:** The concept of personality, Dimensions of personality, Term personality development, Significance. **Attitude and Motivation:** Attitude, Concept, Significance, Factors affecting attitudes, Positive attitude, Advantages, Negative attitude, Disadvantages, Ways to develop positive attitude, Difference between Personalities having Positive and Negative Attitude, Concept of motivation, Significance, Internal and external motives, Importance of self-motivation, Factors leading to demotivation.	8
IV	**Self-Esteem: Term** self-esteem, Symptoms, Advantages, Do's and Don'ts to develop positive self esteem, Low self-esteem, Symptoms, Personality having low self-esteem, Positive and negative self-esteem. **Interpersonal Relationships**: Interpersonal relationships, Teaming, Developing positive personality,	8

	Analysis of strengths and weaknesses.	
V	**Goal-Setting:** Concept of goal-setting, Importance of goals, Dream Vs goal, why goal-setting fails- SMART (Specific, Measurable, Achievable, Realistic, Time-bound) goals, Art prioritization, Do's and Don'ts about goals. **Essential soft skills Assertiveness -** Lateral thinking - Work ethics, good manners and etiquettes Concept, significance.	8

Text Books:

1. Cloninger, S.C., "Theories of Personality: Understanding Person", Pearson, New York, 2008, 5th edition.
2. Luthans F, "Organizational Behaviour", McGraw Hill, New York, 2005, 12th edition.
3. Barron, R.A. & Brian D, "Social Psychology", Prentice Hall of India, 1998, 8th edition

Reference

1. Adler R.B., Rodman G. & Hutchinson C.C., "Understanding Human Communication", Oxford University Press: New York, 2011.

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 35
Total:	100

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Identify different concept of Personality.
CO2: Able to Compare and contrast different personal grooming pertains.
CO3: Able to explore communication beyond language.
CO4: Able to manage oneself while communicating.
CO5: Able to acquire good communication skills and develop confidence.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-III

Programme: DIPLOMA **Class: B.SC**. (CS)	**Year: II** **Semester:**III
Credits Theory:4Cr	**Subject:**Computer System Architecture
Course Code: BCS-NEP-302	**Title:**Computer System Architecture

Course Objectives:
CO1: To learn the concepts regarding microprocessor with 8 bits. To learn the concepts regarding Microprocessor with 16 bits.
CO2: To understand the programming techniques of with the help of Assembly Language Programming.
CO3: To understand the basic concept of parallel computing.
CO4: To understand significance of pipelining and parallelism, so that the devices used to perform According to the need of the designer so as to have appropriate results.
CO5: To understand the concepts of Pipeline scheduling theory

Nature of Paper: DSE

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

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

Unit	Contents	No. of Lectures Allotted
I	Basic Computer Organization and Design: Instructions and Instruction Codes, Computer Registers, Timing and Control, Instruction Cycle, Register Transfer and Micro Operations-Registration Transfer Language, Register Transfer Instructions, Bus and Memory Transfer Instructions, Arithmetic and Logic Micro-Operations, Shift Micro-Operations, Arithmetic Logic Shift Unit; Memory-Reference Instructions, Input-Output and Interrupts, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.	8
II	**Central Processing Unit:** General Register Organization, Stacks Organization, Instruction Formats, Addressing Modes, RISC, CISC, Parallel Processing, Pipelining, Instruction and Arithmetic Pipeline, Vector Processing, Matrix Multiplication, Array Processors.	8
III	**Computer Arithmetic:** Addition, Subtraction Algorithms; Multiplication Algorithms: Shift and Add Algorithms, Booth’s Algorithm; Divisor Algorithms, Floating Point Representations, Arithmetic Operations on Floating-Point Numbers, Decimal Arithmetic Operations.	8
IV	**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Mode of Transfer, Priority Interrupts, Direct Memory Address (DMA), Input/ Output Processor (IOP), Serial Communication.	8
V	**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory	8

	Management Hardware.	

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

Reference
1. Rao, "Prospective in Computer Architecture", Prentice Hall of India
2. John P. Hayes, "Computer Architecture and Organization", McGraw-Hill

Evaluation/Assessment Methodology

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

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-III

<table>
<tr><td colspan="2">Programme:Certificate
Class:B.SC. (CS)</td><td colspan="2">Year: II
Semester: III</td></tr>
<tr><td colspan="1">Credits
Theory:4Cr</td><td colspan="3">Subject:DATA BASE MANAGEMENT SYSTEM</td></tr>
<tr><td colspan="1">Course Code:
BCS-NEP-304</td><td colspan="3">Title:DATA BASE MANAGEMENT SYSTEM</td></tr>
<tr><td colspan="4">Course Objectives:
CO 1: Explain the concept of features of a database system and its application and compare various types of data models.
CO 2: Describe the E-R Models and Relational Database.
CO 3: Explain the concept of SQL Commands, relational algebra, tuple calculus and domain calculus.
CO 4: Explain the need of normalization and normalize a given relation to the desired normal form.
CO 5: Analyze the different approaches of transaction processing and concurrency control.</td></tr>
<tr><td colspan="4">Nature of Paper: CORE COURSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE +ESE)</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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 Modelling 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.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>IV</td><td colspan="2">Transaction Processing Concept: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable</td><td>8</td></tr>
</table>

	Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System	
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. Marks100
1) Class tasks/ Sessional Examination	15
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report	10
5) Seminar On Research Project Report	
6) 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-II/ Semester-III

Programme:UG **Class:**BSC(CS)		Year:II Semester: III
Credits Practical: 2Cr	**Subject:**OOPS USING JAVA LAB	
Course Code: BCS-NEP-305P	**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:40% Marks		
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	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 ArrayindexOutofBounds 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 HerbertzSchildt, “Java-2 The Complete Reference”, McGraw Hill.
2. Balaguruswamy, “Programming with Java: A Primer”, Tata Mc. Graw Hill 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	25 25
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

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –III

Programme:UG **Class: BSC(CS)**	**Year:**II **Semester:**III
Credits Practical: 2Cr	**Subject:** Operating System Lab
Course Code: BCS-NEP-406P	**Title:** Operating System Lab

Course Objectives:
CO1: To Implement the paging Technique 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:**40% Marks**

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

Unit	Contents	No. of Lectures Allotted
I	Write C programs to implement the various Page Replacement Algorithms	2
II	Write C programs to demonstrate various process related concepts.	2
III	Write C programs to implement the various CPU Scheduling Algorithms	2
IV	Write C programs to simulate CPU scheduling algorithms: FCFS, SJF, and Round Robin.	2
V	Implement the following 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 various disk scheduling algorithms	2
VIII	Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.	2

Reference / Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition, Wiley India Private Limited, New Delhi.

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	25 25
Total:	50

Course Learning Outcomes: Student will be able to: CO1: Identify the performance of various page replacement algorithms. CO2: Develop algorithm for deadlock CO3: Choose the best CPU scheduling algorithm for a given problem instance.

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-III

Programme:UG **Class:**B.SC.(CS)	**Year:**II **Semester:**III
Credits Practical: 2Cr	**Subject:**Data Base Management System Lab
Course Code: BCS-NEP-206P	**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:40% Marks

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/DeletingRecords 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 Aggregatefunctions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer JoinSubqueries- 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 (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 Silbers chatz, Korth & Sudarshan, 6th Edition, 2019, McGraw-Hill 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	25
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- IV

<table>
<tr><td colspan="2">Programme:Diploma
Class:B.SC. (CS)</td><td>Year: II
Semester: IV</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="2">Subject:Data Mining</td></tr>
<tr><td>Course Code:
BCS-NEP-404</td><td colspan="2">Title:Data Mining</td></tr>
<tr><td colspan="3">Course Objectives:
CO1: To introduce students to basic applications, concepts, and techniques of data mining. To
CO2: develop skills for using recent data mining software to solve practical problems in a variety of disciplines.
CO3: To extract knowledge from data repository for data analysis, frequent pattern, classification and prediction.
CO4: Understand and implement classical models and algorithms in data warehouses and data mining.
CO5: Master data mining techniques in various applications like social, scientific and environmental context.</td></tr>
<tr><td colspan="3">Nature of Paper: DSE</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks (ISE +ESE)</td></tr>
<tr><td colspan="3">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit</td></tr>
</table>

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Data Mining - Overview, Motivation, Definition & Functionalities, Major issues in Data Mining, Integration of Data Mining System with Data Warehouse System. **Data Preprocessing**: Descriptive Data Summarization, Data Cleaning-Missing Values, Noisy Data, Data Integration and Transformation, Data Reduction-Data Cube Aggregation, Attribute Subset Selection, Dimensionality Reduction, Numerosity Reduction, Discretization and Concept Hierarchy.	10
II	**Association Rules:** Introduction, Frequent Item sets, Closed Item sets, Methods to Discover Association Rules, Apriori Algorithm, Multilevel Association Rule Mining, and Rule Evaluation Metrics.	10
III	**Classification and Prediction:** Classification Techniques-Decision Tree, Rule-Based Classification, Bayesian Classification, k-Nearest-Neighbor Classifier, Linear Regression, Accuracy and Error Measures,	10
IV	**Cluster Analysis:** Introduction, Types of Data, Partitioning Methods- k-Means and k-Medoids, Hierarchical Clustering- Chameleon, Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods-Neural Network Approach, Outlier Analysis.	10
V	**Recent Trends and Applications:** Web Mining, Spatial Data Mining, Text Mining, Multimedia Data Mining, Applications of data mining in finance, business, social networks.	10

Text Books: 1. Jiawei Han, Jian Pei, MichelineKamber, *"Data Mining: Concepts and Techniques"*, Elsevier.	
Reference: 1. Margaret H. Dunham, "*Data Mining: Introductory and Advanced Topics",* Pearson Education. 2. Arun K. Pujari, *"Data Mining Techniques"*, Universities Press. 3. Pieter Adriaans&DolfZantinge, *"Data Mining"*, 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 the functionality of the various data mining and data warehousing component. CO2: Appreciate the strengths and limitations of various data mining and data warehousing models. Explain the analyzing techniques of various data CO3: Describe different methodologies used in data mining and data ware housing. CO4: Compare different approaches of data ware housing and data mining with various CO5: technologies.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-IV

Programme: Diploma **Class:**B.Sc. (CS)	**Year:** II **Semester:**IV
Credits Theory:4Cr	**Subject:** Operating System
Course Code: BCS-NEP-402	**Title:** Operating System

Course Objectives:
CO1: To understand the services provided by and the design of an operating system.
CO2: To understand the structure and organization of the file system.
CO3: To understand what a process is and how processes are synchronized and scheduled.
CO4: To understand different approaches to memory management.
CO5: Students should be able to use system calls for managing processes, memory and the file system.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks (ISE +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: -** Operating System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview, objectives and functions, Evolution of Operating System, Types of Operating Systems.	12
II	**PROCESSES: -**Process States, Process Description and Process Control Block. Processes and Threads, Types of Threads, Multicore and Multithreading, Scheduling Types of Scheduling, Scheduling algorithms.	12
III	**CONCURRENCY AND SCHEDULING: -** Principles of Concurrency-Mutual Exclusion, Semaphores, Monitors, Readers/Writers problem. Deadlocks-prevention, avoidance, detection, Banker's Algorithm.	12
IV	**MEMORY MANAGEMENT: -** Memory management requirements, Partitioning, Paging and Segmentation, Virtual memory - Hardware and control structures, Page fault, Page replacement algorithms, operating system software, Linux memory management, Windows memory management.	12
V	**INPUT/OUTPUT AND FILE SYSTEMS: -** I/O management and disk scheduling – I/O devices, organization of I/O functions; OS design issues, I/O buffering, disk scheduling, Disk cache. File management – Organization, Directories, File sharing, and Record blocking, secondary storage management.	12

Text Books:
1. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley
2. Andrew S. Tanenbaum, "Modern Operating System", PHI Learning
3. Tanenbaum /Woodhaull "Operating System Design and Implementation", Pearson Publication.

Reference:
1. Harvey M Dietel, "An Introduction to Operating System", Pearson Education
2. Flynn, "Understanding Operating System", Cengage.
3. D M Dhamdhere, "Operating Systems: A Concept based Approach", McGraw Hill.
4. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education".

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 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.

IIMTU-NEP IMPLEMENTATION
Year- II / Semester- IV

Programme: Diploma **Class:**B.Sc. (CS)		**Year:**II **Semester:**IV
Credits Theory:4Cr	**Subject:** Numerical Analysis	
Course Code: BCS-NEP-404	**Title:**Numerical Analysis	

Course Objectives:

CO1: Basic understanding of numerical Algorithms.

CO2: Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques.

CO3: Use the concepts of interpolation, Eigen value problem techniques for mathematicalproblems arising in various fields.

CO4: Solve initial value and boundary value problems which have great significance inengineering practice using ordinary and partial differential equations.

CO5: Demonstrate elementary programming language, implementation of algorithms andcomputer programs to solve mathematical problems.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (ISE +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:** Numbers representation on a computing machine with particularization to single precision, double precision, quadruple precision and the Intel 86 family of processors. Definitions of numerical rounding error and chopping error. Discussion of major sources of error in numerical analysis	8
II	**Solution of algebraic equations:** Description of Bijection algorithm and its coding; Method of False Position and its coding; The Secant algorithm and its coding; The Newton-Raphson algorithm and its coding. Brief discussion ofthe robustness and relative performance of these algorithm., Properties of the fixed-point algorithm xn+1 = g(xn) given x0.Definition of the Lipshitz condition and the notion of a contraction algorithm. - Conditions for convergence of xn+1 = g(xn), Error estimation for algorithm xn+1 = g(xn), General notion of the order of an iterative algorithm, Aitken acceleration and Steffensen's algorithm, Solution of systems of algebraic equations	8
III	**Numerical Interpolation:**Polynomial interpolation., Definition of the Lagrange interpolating polynomial, Interpolation based on the Lagrange interpolating polynomial, Newton interpolation using divided differences, Error analysis underlying polynomial interpolation based on, Rolle's theorem. -The Chebyshev Economization and its optimality, Piecewise linear spline, Subpoint quadratic spline, Construction of the cubic spline, Least-squares data fitting; its use and implementation	8

IV	**Solution of linear equations:** Concept of Gaussian elimination, the concept of pivoting and asimple illustration of why pivoting is needed, LU factorization of matrices with and without partial/full pivoting, The Choleski factorization, Matrix inversion Iterative methods, The concept of a matrix norm with simple examples, e.g., theFrobenius norm,The Jacobi iteration algorithm, The Gauss-Seidel algorithm, The Gauss-Seidel algorithm with over-relaxation	8
V	**Numerical calculation of matrix eigenvalues:**Gershgorin's theorem with an example - The Power algorithm, The Inverse Power algorithm, The Jacobi transformation, The Householder transformation, Construction of the Upper Hessenberg matrix, The QR algorithm	8

Text Books:

1. V. A. Patel. Numerical Analysis. Harcourt Brace, College Publishers, 1994.
2. W. Cheney and D. Kincaid. Numerical Mathematics and Computing. Brooks/Cole Publishing Company, 2003.

Reference

1. Numerical Analysis. 9thed. R.L. Burden and J.D. Faires: Edition Brooks / cole: -73563-538-0-978.2011136
2. An Introduction to Numerical Analysis. EndreSüli, David F. MayersCambridge : -0521810264 -2003.0521007941

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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: Discuss robustness and relative performance of different algorithm.
CO2: Able to apply interpolation methods for solving the problems numerically.
CO3: Able to calculate the errors and the rates of convergence.
CO4: Able to evaluate the relationships between different areas of mathematics and the connections between Mathematics another disciplines.
CO5: Able to develop numerical algorithms for the solution of the algebraic eigenvalueproblem.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester- IV

Programme: Diploma **Class:**BSC(CS)	Year: II Semester: IV
Credits Theory:4Cr	**Subject:**Software Engineering
Course Code: BCS-NEP-401	**Title:**Software Engineering

Course Objectives:
CO 1: Select and implement different software development process models.
CO 2: Extract and analyze software requirements specifications for different projects. Develop some
CO 3: basic level of software architecture/design.
CO 4: Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress.
CO 5: Apply different testing and debugging techniques and analyzing their effectiveness.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks (ISE +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:** 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	10
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, Behavioral Modeling, Control Specification, Process Specification, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.	10
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, Component-Level Design, Deployment-Level Design, Implementation Issues and Programming Support Environment, Quality Metrics for Design Model and Source Code	10
IV	**Software Testing:** Verification, Validation, Testing Objectives, Unit Testing,	10

	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.	
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, Configuration Audit, Metrics for Maintenance.	10

Text Books:

1. Roger S. Pressman, “Software Engineering: A Practitioner's Approach”, Addison Wesley.
2. PankajJalote, “An Integrated Approach to Software Engineering”, Springer.

Reference:

1. K. K. Aggarwal &Yogesh Singh “Software Engineering”, New Age International.
2. 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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO 1: Select and implement different software development process models.
CO 2: Extract and analyze software requirements specifications for different projects.
CO 3: Develop some basic level of software architecture/design.
CO 4: Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress.
CO 5: Apply different testing and debugging techniques and analyzing their effectiveness.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester- IV

Programme: Certificate **Class:**All UG Classes of IIMT University	**Year**:II **Semester**:IV
Credits Theory- 3Cr	**Subject:**Human values and professional ethics
Course Code Theory : UVE-401	**Title:**Human values and professional ethics

Course Objectives:

CO1:	To reinstate the rich cultural legacy and human values of which we are the custodians.
CO2:	To focus on professional ethics which are broader indicators of desirable actions vis-à-vis undesirable actions.
CO3:	To lay down broader guidelines of values and ethics for internal and external stakeholders.
CO4:	To suggest operational guidelines for value-based and ethical practices in the higher educational institutions leading to implementation and monitoring.
CO5:	To indicate the outcomes of creating a value-based and ethical culture in HEIs.
CO6:	To suggest indicative reinforcement programmes for nurturing human values and ethics in HEIs.

Nature of Paper: Core/DSE/SEC/GE/AECC-AECC

Minimum Passing Marks/Credits:40% Marks

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

Unit	Contents(Theory)	No. of Lectures Allotted
I	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education	6
II	Understanding Harmony in the Human Being - Harmony in Myself	6
III	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship	6
IV	Understanding Harmony in the Nature and Existence - Whole existence asCo-existence	6
V	Implications of the above Holistic Understanding of Harmony on Professional Ethics	6

Suggested Readings: For Theory

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond &Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantra Shodh,Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford UniversityPress
10. M Govindrajan, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted2008.
13. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course inHuman Values and Professional Ethics.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	10 marks
2) Presentations /Seminar	05 marks
3) Assignments	NA
4) Research Project Report	NA
Seminar On Research Project Report	35
5) ESE	
Total:	15+35 Internal+External

Prerequisites for the course: First year must be clear for appearing in IIIrd/IVth for the study of this Audit/Qualifying course**- for theory**
Second year must be clear for appearing in VIthSem for the study of this audit/Qualifying Course **- for theory**

Course Learning Outcomes:

CO1: The learning process for holistic development.
CO2: Impeccable governance.
CO3: Effective institutional management.
CO4: Well laid system of rewards and chastisement.
CO5: Institutional climate where ‘rights’ enjoy and ‘wrongs’ are discouraged.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester- IV

<table>
<tr><td colspan="2">Programme: UG
Class: BSC(CS)</td><td colspan="2">Year: II
Semester:IV</td></tr>
<tr><td>Credits
Practical: 2Cr</td><td colspan="3">Subject:Software Engineering Lab</td></tr>
<tr><td>Course Code:
BCS-NEP-405P</td><td colspan="3">Title:Software Engineering Lab</td></tr>
<tr><td colspan="4">Course Objectives:
CO1: Understand and describe basic concept of UML, design, implementation of test cases and OOP concepts using java
CO2: Discuss and Analyses how to develop software requirements specifications for a given problem.
CO3: Explain and build DFD models
CO4: Understand and develop various structure and behavior UML diagrams.
CO5: Explain the knowledge of project management tool Demonstrate how to manage file using Project Libre project management tool.</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">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</td><td>2</td></tr>
<tr><td>II</td><td colspan="2">Preparation of Software Requirement Specification Document, Design Documents and</td><td>2</td></tr>
<tr><td>III</td><td colspan="2">Identify the classes. Classify them as weak and strong classes and draw the class diagram.</td><td>2</td></tr>
<tr><td>IV</td><td colspan="2">Preparation of Software Configuration Management and Risk Management related documents</td><td>2</td></tr>
<tr><td>V</td><td colspan="2">Study and usage of any Design phase CASE tool</td><td>2</td></tr>
<tr><td>VI</td><td colspan="2">Prepare SRS document in line with the IEEE recommended standards.</td><td>2</td></tr>
<tr><td>VII</td><td colspan="2">Develop test cases for unit testing and integration testing</td><td>2</td></tr>
<tr><td>VIII</td><td colspan="2">Develop test cases for various white box and black box testing techniques.</td><td>2</td></tr>
<tr><td>IX</td><td colspan="2">Draw the activity diagram</td><td>2</td></tr>
<tr><td>X</td><td colspan="2">Draw the state chart diagram.</td><td>2</td></tr>
<tr><td colspan="4">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. KK Aggarwal and Yogesh Singh, Software Engineering, New Age International Publishers.</td></tr>
</table>

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	25 25
Total:	50

Course Learning Outcomes:
Student will be able to:
CO1: Draw a class diagram after identifying classes and association among the
CO2: Graphically represent various UML diagrams, and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially
CO3: Able to use modern engineering tools for specification, design, implementation and testing
CO4: Develop test cases for various white box and black box testing techniques.

IIMTU-NEPIMPLEMENTATION
Year-III/ Semester-V

Programme: Degree **Class:**BSC(CS)	**Year:** III **Semester:** IV
Credits Theory:4Cr	**Subject:** 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 (ISE+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 localtests, 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, Avroand file-based data structures. Hadoop Environment: Setting up a Hadoop cluster,cluster specification, cluster setup and installation, Hadoop configuration, securityin 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. **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 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, BigInsights 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) Classt asks/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.

IIMTU-NEP IMPLEMENTATION
Year-III/ Semester-V

Programme: Degree **Class:**BSc (CS)	**Year:** III **Semester:**V
Credits Theory:4Cr	**Subject:**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 Practicaloriented 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 (ISE +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; Testing; Going Live; End-User Training; Post Implementation (Maintenance	8

	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 2) Presentations /Seminar 3) Assignments	15
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.

IIMTU-NEPIMPLEMENTATION
Year-III/ Semester-V

Programme: Certificate **Class:B.SC. (CS)**	**Year:**III **Semester:**V
Credits Theory:4Cr	**Subject:** 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 (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: 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	10
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.	10
III	Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services,	10
IV	Network layer: Logical Addressing, Internetworking, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.	10
V	Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.	10

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	10
Seminar On Research Project Report	
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.

IIMTU-NEP IMPLEMENTATION
Year-III/ Semester-V

Programme: Degree **Class:** B.SC(CS)	Year: III Semester: V
Credits Theory:4Cr	**Subject:**Computer Graphics
Course Code: BCS-NEP-501	**Title:**Computer Graphics

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 ofProjections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks (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	**GeometricTransformations:**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-Viewport Transformations, Convex and Concave Clipping, Point Clipping, Line Clipping-Cohen-Sutherl and Polygon Clipping, Liang-Bar sky Line Clipping, Cyrus-Beck Algorithm, Midpoint Subdivision 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-Buffer algorithm, Scan Line Algorithm, Area subdivision algorithm	8

Reference:

1. SteveMarschner, Peter Shirley, "*Fundamentals of Computer Graphics*", CRC Press.
2. John Vince,"*Mathematic sfor Computer Graphics*",Springer.

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

Prerequisites for the course: NIL

Course Learning Outcomes:

CO 1: Learned and solved different types of display techniques...
CO 2: WAP for Point, Line, Circle, Ellipse, Polygon algorithm.
CO 3: Learned and Solved 2D Transformations and Composition of 3-D Transformation.
CO 4: Applied Point, Text, Line, Polygon Clipping and Cohen-Sutherl and Clipping Algorithm
CO 5: Learned and Solved Pipeline and Different Types ofProjections techniques.

Format-3

IIMTU-NEPIMPLEMENTATION
Year-III/ Semester-V

<table>
<tr><td colspan="2">Programme:Degree
Class:B.SC.(CS)</td><td>Year:III
Semester: V</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="2">Subject: Python Programming</td></tr>
<tr><td>Course Code:
BCS-NEP-502</td><td colspan="2">Title:Python programming</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td colspan="3">Nature of Paper: Core course</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="3">L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
</table>

Unit	Contents	No. ofLectures 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	10
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.	10
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).	10
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.	10
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.	10

	Dealing with Excelϖ GUIϖ Web Scrappingϖ	

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)
2. Python Training guide (BPB Publications)

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/SessionalExamination 2) Presentations/Seminar 3) Assignments	15
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

<table>
<tr><td colspan="2">Programme:UG
Class:B.SC. (CS)</td><td colspan="2">Year:III
Semester:V</td></tr>
<tr><td colspan="2">Credits
Practical: 2Cr</td><td colspan="2">Subject:Python Programming Lab</td></tr>
<tr><td colspan="2">Course Code:
BCS-NEP-505P</td><td colspan="2">Title:Python Programming Lab</td></tr>
<tr><td colspan="4">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 Pythonϖ Programming.</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Sr.</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">Write a python script to check whether a given number is even or odd.</td><td>1</td></tr>
<tr><td>II</td><td colspan="2">Write a Python script to add two integers' values taken from user.</td><td>1</td></tr>
<tr><td>III</td><td colspan="2">Write a python script to calculate area of circle where radius is taken from user.</td><td>1</td></tr>
<tr><td>IV</td><td colspan="2">Write a program to copy the content of one file to another file.</td><td>1</td></tr>
<tr><td>V</td><td colspan="2">Write a Python Program to find the sum of series: 1 + 1/2 + 1/3.</td><td>1</td></tr>
<tr><td>VI</td><td colspan="2">Write a program to find the sum of n natural numbers.</td><td>1</td></tr>
<tr><td>VII</td><td colspan="2">Write a program to find factorial of a given number.</td><td>1</td></tr>
<tr><td>VIII</td><td colspan="2">Write a program to find whether a given number is Armstrong number or not.</td><td>1</td></tr>
<tr><td>IX</td><td colspan="2">Write a program takes a number and computes the prime factors of the integer.</td><td>1</td></tr>
<tr><td>X</td><td colspan="2">Program to check whether a given number is a palindrome.</td><td>1</td></tr>
<tr><td colspan="4">Text Books:
1. Pooja Sharma, "Programmingin Python", BPB Publications.
2. Mark Summer field, "Programming in Pythona Complete Introduction to the Python Language", Pearson Education.</td></tr>
<tr><td colspan="4">Reference:
1. Mark Lutz, "Programming Python", O'Reilly Media.
2. Wesley Chun, "Core Python Programming", Prentice Hall.
3. Alex Martelli, "Pythonidae Nutshell", O'Reilly Media.</td></tr>
</table>

Format-3

IIMTU-NEP IMPLEMENTATION
Year-III/ Semester-V

Programme:UG **Class:** BSC(CS)		Year: III Semester: V
Credits Practical :2 Cr	**Subject:**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 ofProjections techniques.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks (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: Principle & 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 2) Presentations /Seminar 3) Assignments 4) Research Project ReportSeminar on Research Project Report	25
5) ESE	25
Total:	50

Prerequisites for the course: NIL
Course Learning Outcomes: CO 1: Learned and solved different types of display techniques. CO 2: WAP for Point, Line, Circle, Ellipse, Polygon algorithm. CO 3: Learned and Solved 2DTransformations and Composition of 3-D Transformation. CO 4: Applied Point,Text, Line, Polygon Clipping and Cohen-SutherlandClipping Algorithm CO 5: Learned and Solved Pipeline and Different Types ofProjections techniques.

Format-3

IIMTU-NEPIMPLEMENTATION
Year-III/ Semester-VI

Programme: Degree **Class:**BSC(CS)	**Year:** III **Semester:** VI
Credits Theory:4Cr	**Subject:** 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 o fPaper: Core Course

Minimum Passing Marks/Credits:40% Marks (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 Ethical Hacking:**Key issues plaguing the information security world, incident management process, and penetration testing, **Footprinting 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 Trojans, 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, "Guideto 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	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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-VI

Programme: Degree **Class:**B.SC. CS	**Year:** III **Semester:**VI
Credits Theory:4Cr	**Subject:**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-
CO2: commerce.
CO3: Explain electronic system and Internet.
CO4: Describe the use of e-commerce security.
CO5: To provide adequate knowledge and understanding about E-Com practices to the students. Understand the usage of planning and marketing for e-commerce.

Nature of Paper:DSE

Minimum Passing Marks/Credits:40% Marks (ISE +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 Networks, 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	10
Seminar On Research Project Report	
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:**B.SC. CS	**Year:** III **Semester:** VI
Credits Theory:4Cr	**Subject:** 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 (ISE +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 Weiss, "Mobile Computing", Kluwer Academic Publishers.
2. UWE Hansmann, Lothar Merk, Martin-S-Nickie's, Thomas Stone, "Principles of Mobile Computing", Springer International Edition.
3. Wireless and Mobile Networks Architectures, by Yi-Bing Lin & Imrich Champak, 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 Richter, Springer Publishing, 2000.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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.

IIMT UNIVERSITY — MEERUT (U.P.) — Transforming Education System, Transforming Lives

UGC Approved Section 2f & 12B

Format-3

IIMTU-NEP IMPLEMENTATION
Year-III/ Semester-VI

Programme: Degree **Class:**B.Sc. (CS)	**Year:**III **Semester:** VI
Credits Theory:4Cr	**Subject:**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 (ISE +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- Mispacking- 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:** Petri nets and applications in real-time modelling, 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 - Hill, 2010.
2. Giorgio C. Bottazzi, "Hard real-time computing systems: predictable scheduling algorithms and applications", Springer, 2008.

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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: UG **Class: BSC(CS)**		**Year:**III **Semester:**VI
Credits Practical: 2Cr	**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:40% Marks

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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	25
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.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-III/ Semester-VI

<table>
<tr><td colspan="2">Programme:UG
Class:B.SC.(CS)</td><td colspan="2">Year: III
Semester: VI</td></tr>
<tr><td colspan="2">Credits
Practical: 2Cr</td><td colspan="2">Subject:Cyber Security Lab</td></tr>
<tr><td colspan="2">Course Code:
BCS-NEP-605P</td><td colspan="2">Title:Cyber Security Lab</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:0
T:0
P:4(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=2Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">Checklist for reporting cybercrime at Cybercrime Police Station.</td><td>2</td></tr>
<tr><td>II</td><td colspan="2">Checklist for reporting cybercrime online.</td><td>2</td></tr>
<tr><td>III</td><td colspan="2">Basic checklist, privacy and security settings for popular social media platforms.</td><td>2</td></tr>
<tr><td>IV</td><td colspan="2">Checklist for secure net banking.</td><td>2</td></tr>
<tr><td>V</td><td colspan="2">Setting and configuring two factor authentication in the Mobile phone.</td><td>2</td></tr>
<tr><td>VI</td><td colspan="2">Installation and configuration of computer Anti-virus.</td><td>2</td></tr>
<tr><td>VII</td><td colspan="2">Wi-Fi security management in computer and mobile.</td><td>2</td></tr>
<tr><td>VIII</td><td colspan="2">Setting and configuring two factor authentications in the Mobile phone.</td><td>2</td></tr>
<tr><td colspan="4">Reference / Text Books:
1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Author Press. Edition 2010.
2. Electronic Commerce by Elias M. Awed, 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, McGraw Hill.</td></tr>
<tr><td colspan="4">If the course is available as Generic Elective, then the students of following departments may opt it.</td></tr>
</table>

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	25 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.

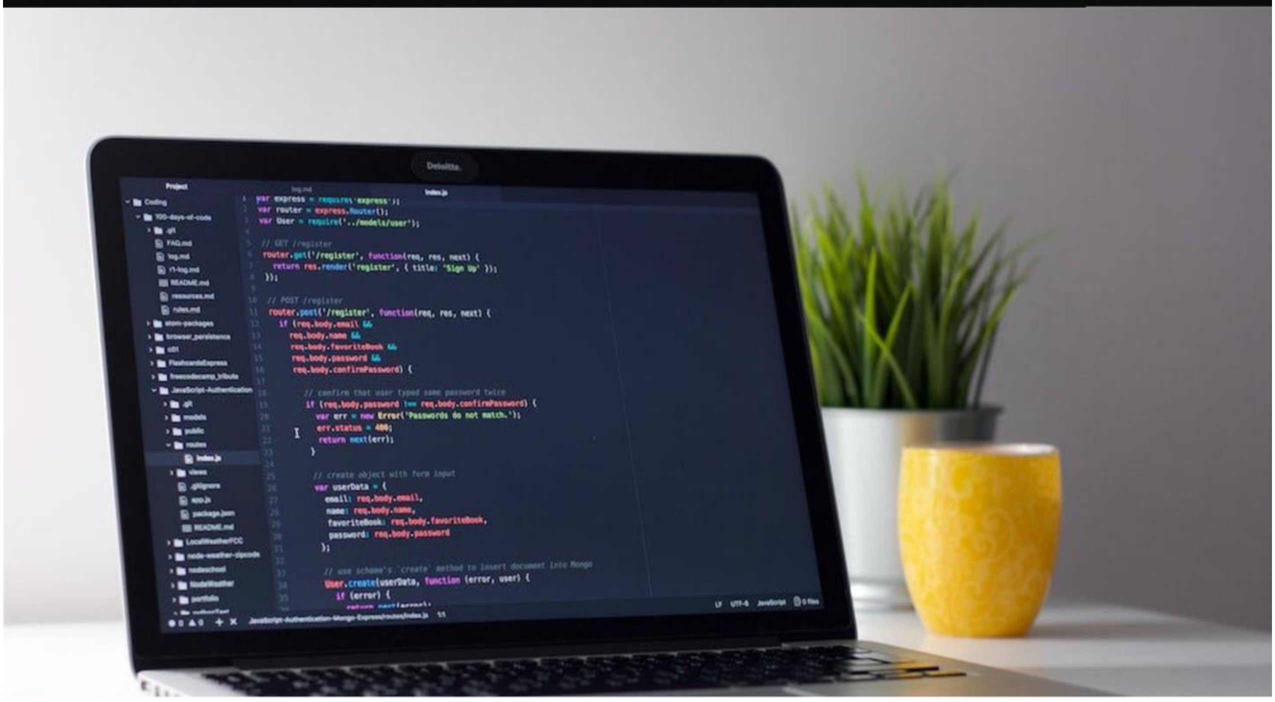
CO3: On completion of this module, students should be able to appreciate various privacy and security concerns on online social media and understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of social media platforms.

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.

School of Computer Science & Applications

ACADEMIC HANDBOOK



Ordinance & Academic Regulations
B.Sc. -CS (Data Science)

Index

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 LOCFinculcation 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.
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 who is responsible for all academic activities of various programmes and implementation of relevant rules of these Regulations pertaining to the AcademicProgrammes.
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 gradesheets 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"meansBoardofStudies.
14. "ACM" means Academic Council Meeting the highest authoritative body for approval for allAcademicPolicies.
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 thesemester.
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 EducationInstitutions.
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 academicmaturity 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.-CSprogramme 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.

h. Credits earned under Non CGPA courses.

22. CLAS/DIVISION

22.1 Classification is based on CGPA and is as follows:

CGPA $\geq$ 8.0	: **First Class with distinction**
6.5 $\leq$ CGPA <8.0	: **First Class**
5.0 $\leq$ 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 fulfilsthose 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 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 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 DISCIPLINE

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

27. STUDENT WELFARE

Any act of indiscipline of a student reported to the Dean (Students Welfare) and Head of theDepartment will be referred to a Discipline Committee constituted for the purpose. The Committeewill 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-Chancellorfor the implementation of the decision. The student concerned may appeal to the Vice-Chancellor,whosedecisionwillbethefinal.

28. RAGGING

Ragging in any form is a criminal and non-bailable offence in our country. The current State andCentrallegislationsprovidestringentpunishmentsincludingimprisonment.Oncetheinvolvemen tofastudent(s) is established in ragging, offending fellow students/staff, harassment of any nature to thefellow students/staff etc. the student(s) will be liable to be dismissed from the University, as per thelaid down procedures of the UGC / Govt. /Institute. Every senior student at the University, along withtheir parent, shall give an undertaking every year in this regard and the same should be submitted at the timeofRegistration.

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) SEMESTER-I										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCS-NEP-101	Problem Solving using C	C1	4	0	0	25	75	**100**	**4**
2	BCS-NEP-111	SPT-I (Probability & Statistics)	C2	4	0	0	25	75	**100**	**4**
3	BCS-NEP-104	1. Mathematics-I 2. Discrete Mathematics	DSE	4	0	0	25	75	**100**	**4**
4	NHU-111	English Communication	AECC	3	0	0	15	35	**50**	**3**
5	BCS-NEP-105P	Problem Solving using C Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
6	BCS-NEP-112P	SPT-I (Probability & Statics Lab)	CORE LAB 2	0	0	4	25	25	**50**	**2**
		Grand Total		**15**	**0**	**8**	**140**	**310**	**450**	**19**

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: STUDENT CAN TAKE NCC (GENCC-101) AS A GENERAL ELECTIVE/OPTIONAL COURSE AND CERTIFICATE WILL BE PROVIDED AFTER COMPLETION OF NCC COURSE.

B.Sc COMPUTER SCIENCE (DATA SCIENCE) SEMESTER-II										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCS-NEP-201	Data Structure and Algorithms using C	C1	4	0	0	25	75	**100**	**4**
2	BCS-NEP-211	SPT-II (Linux& Administration)	C2	4	0	0	25	75	**100**	**4**
3	BCS-NEP-204	1. Mathematics-II 2. Optimization Techniques	DSE	4	0	0	25	75	**100**	**4**
4	*Code will be decided by parent department	GE-I (To be opted by the students as per the given electives in the list attached)	GE (Mandatory)	4	0	0	25	75	**100**	**4**
5	NHU-112	Environmental & Ecology	AECC	3	0	0	15	35	**50**	**3**
6	BCS-NEP-205P	Data Structure and Algorithms using C Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
7	BCS-NEP-212P	SPT-II (Linux& Administration Lab)	CORE LAB 2	0	0	4	25	25	**50**	**2**
8	BCS-NEP-207P	MOOCS/NPTEL	SEC	4	0	0	50	0	**50**	**4**
		Grand Total		**23**	**0**	**8**	**215**	**385**	**600**	**27**
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) SEMESTER-III										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCS-NEP-301	OOPS using JAVA	C1	4	0	0	25	75	**100**	**4**
2	BCS-NEP-311	SPT-III (Machine Learning)	C2	4	0	0	25	75	**100**	**4**
3	BCS-NEP-302	1. Computer System Architecture 2. Data Analytics	DSE	4	0	0	25	75	**100**	**4**
4	BCS-NEP-303	Communication Skill & Personality Development	AECC	3	0	0	15	35	**50**	**3**
5	BCS-NEP-305P	OOPS using JAVA Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
6	BCS-NEP-312P	SPT-III (Machine Learning Lab)	CORE LAB 2	0	0	4	25	25	**50**	**2**
		Grand Total		**15**	**0**	**8**	**140**	**310**	**450**	**19**

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: STUDENT CAN TAKE NCC (GENCC-101) AS A GENERAL ELECTIVE/OPTIONAL COURSE AND CERTIFICATE WILL BE PROVIDED AFTER COMPLETION OF NCC COURSE.

B.Sc COMPUTER SCIENCE (DATA SCIENCE) SEMESTER-IV										
S. No.	**Subject Code**	**Subject Name**	**Course Type**	**Evaluation Scheme**						
				Periods			**Internal Marks**	**External Marks**	**Total Marks**	**Credits**
				L	**T**	**P**				
1	BCS-NEP-401	Software Engineering	C1	4	0	0	25	75	**100**	**4**
2	BCS-NEP-411	SPT-IV (Artificial Intelligence)	C2	4	0	0	25	75	**100**	**4**
3	BCS-NEP-404	1. Data Mining 2. Numerical Analysis	DSE	4	0	0	25	75	**100**	**4**
4	*Code will be decided by parent department	GE-2(To be opted by the students as per the given electives in the list attached)	GE-2 (Mandatory)	4	0	0	25	75	**100**	**4**
5	UVE-401	Human Values and Professional Ethics	AECC	3	0	0	15	35	**50**	**3**
6	BCS-NEP-405P	Software Engineering Lab	CORE LAB 1	0	0	4	25	25	**50**	**2**
7	BCS-NEP-412P	SPT-IV (Artificial Intelligence Lab)	CORE LAB 2	0	0	4	25	0	**50**	**2**
8	BCS-NEP-407P	MOOCS/NPTEL	SEC	4	0	0	50	0	**50**	**4**
		Grand Total		**23**	**0**	**8**	**215**	**360**	**600**	**25**
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) 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.

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**

B.Sc COMPUTER SCIENCE (DATA SCIENCE)
SEMESTER-VI

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

IIMTU-NEP IMPLEMENTATION
CBCS: Statement of Credit distribution

College/School: SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS Programme: B.Sc. - CS [DATA SCIENCE] Duration: 3 YEARS Annual/Semester: SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee)

Minimum Credit Score Required for Certificate (40)	First Year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP)	Prerequisite
CERTIFICATE	First Year Credit (46)	I	Problem Solving Using C (Th. 4 Cr.+ P 2Cr.) Probability Statistics (Th. 4 Cr.+ P 2Cr.) SPT-I	English Communication (Th. 3 Cr.)		1. Mathematics I 2. Discrete Mathematics (Th. 4 Cr.)			
		II	Data Structure Algorithms using C (Th. 4 Cr. + P 2Cr.) Linux&Administration (Th. 4 Cr. + P 2Cr.) SPT-II	Environment &Ecology (Th. 3 Cr.)	MOOC/NPTEL 4 Cr.	1. Mathematics II 2. Optimization Techniques (Th. 4 Cr.)	GE-I (Mandatory)(Th. 4 Cr.)		Problem Solving using C Mathematics I

Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.

College/School: SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS Programme: B.Sc. - CS [DATA SCIENCE] Duration: 3 YEARS Annual/Semester: SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee) Provision to change the stream onwards

Minimum Credit Score Required for Diploma (80)	Second Year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP)	Prerequisite
DIPLOMA	Second Year Credit (46)	III	OOPS using JAVA (Th. 4 Cr.+ P 2Cr.) Machine Learning (Th. 4 Cr.+ P 2Cr.) SPT-III	Communication Skill & Personality Development (Th. 3 Cr.)		1. Computer System Architecture 2. Data Analytics (Th. 4 Cr)			
		IV	Software Engineering (Th. 4 Cr. + P2Cr.) Artificial Intelligence (Th. 4 Cr.+ P 2Cr.) SPT-IV	Human Values and Professional Ethics (Th. 3 Cr.)	MOOC/NPTEL 4 Cr.	1. Data Mining 2. Numerical Analysis (Th. 4 Cr.)	GE-II (Mandatory) 4 Cr.		

Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course.

College/School: SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS Programme: B.Sc. - CS [DATA SCIENCE] Duration: 3 YEARS Annual/Semester: SEMESTER	Credit Range: 120 - 160 (Suggested by CBCS Committee) Provision to change the Core Papers (Main Subject)

Minimum Credit Score Required for Diploma (120)	Third Year	Semester	Core Course/ Foundation Course	Ability Enhancement Compulsory Course (AECC)	Skill Enhancement Course (SEC)	Discipline Specific Elective (DSE)	Generic Elective (GE) (From other Faculty)	Research Project (RP)	Prerequisite
DEGREE	Third Year Credit (50)	V	SPT-V (Th. 4 Cr. + P 2Cr.) SPT-VI (Th. 4 Cr. + P 2Cr.)			1. Data Communication Network 2. ERP 3. BIG Data (Th. 4 Cr.)		RP-1 (AUDIT) (Non-Credit) Research Project-I Internship (5 Cr.)	
		VI	SPT-VII (Th. 4 Cr. + P 2Cr.) SPT-VIII (Th. 4 Cr. + P 2Cr.)		MOOC/NPTEL 4 Cr.	1. Mobile Computing 2. E-Commerce 3. Real Time System (Th. 4 Cr.)	GE - III (Mandatory) 4 Cr.	RP-2 (AUDIT) (Non-Credit) Research Project-II Industrial Project (5 Cr.)	

Note: - Students can take NCC (GENCC-101) as a General Elective/Optional course and certificate will be provided after competition of NCC Course

Format-2

Format-2

IIMTU-NEP Implementation: B.Sc (Computer Science-Data Science)

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(46 Cr.)**	**SEMESTER -I (19 Cr.)**	i) C1 (Th. 4 Cr. + P 2 Cr.) ii) AECC-I iii) DSE-I	4 2 3 4	4 4 3 4	45 10 40 45	Problem Solving using C Problem Solving using C lab English Communication 1. Mathematics-I 2. Discrete Mathematics	5 5 5		
			ii) C2(Th.4 Cr.+P 2Cr)	4 2	4 4	45 10	@SPT – I @SPT - I Lab	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 – II(27 Cr.)	i) C3 (Th. 4 Cr. + P 2 Cr.) ii) AECC-II iii) SEC-I & II iv) DSE-II v)GE-I	4 2 3 4 4 4	4 4 3 4 4 4	45 10 40 40 45 45	Data Structure Algorithms using C Data Structure Algorithms using C LabEnvironment &Ecology MOOCS (NPTEL) 1. Mathematics-II 2. Optimization Techniques #To be selected from another School	5 5 5 5 5		
			ii) C4 (Th.4Cr.+P 2 Cr.)	4 2	4 4	45 10	@SPT – II @SPT - II Lab	5		

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: 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.

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(46 Cr.)	SEMESTER –III(19 Cr.)	i) C5 (Th. 4 Cr. +	4	4	45	OOPS using Java	5		
			P 2 Cr.)	2	4	10	OOPS using Java Lab			
			ii) AECC-III	3	3	40	Communication Skill & Personality Development	5		
			iii) DSE-III	4	4	45	1. Computer System Architecture 2. Data Analytics	5		
			i) C6 (Th. 4 Cr. +	4	4	45	@SPT – III	5		
			P 2 Cr.)	2	4	10	@SPT - III Lab			
			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(27 Cr.)	i) C7 (Th. 4 Cr. +	4	4	45	Software Engineering	5		
			P 2 Cr.)	2	4	10	Software Engineering Lab			
			ii) AECC-IV	3	3	40	Human values and Professional	5		
			iii) SEC-III& IV	4	4	40	Ethics	5		
			iv) DSE-IV	4	4	45	MOOCS (NPTEL) 1. Data Mining	5		
			v) GE-II	4	4	45	2. Numerical Analysis #To be opted from anotherSchool	5		
			ii) C8 (Th. 4 Cr. +	4	4	45	@SPT – IV	5		
			P 2 Cr.)	2	4	10	@SPT - IV Lab			

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 (50 Cr.)	SEMESTER –V (21 Cr.)	i) C9 (Th. 4 Cr. + P 2 Cr.) ii) DSE-V	4 2 4	4 4 4	45 10 45	@SPT – V @SPT - V Lab 1. Data Communication Network 2. ERP 3. BIG Data	5 5		
			ii) C10 (Th. 4 Cr. +P 2 Cr.)	4 2	4 4	45 10	@SPT – VI@SPT - VI Lab	5		
			iii) Research Project iv) Internship (Mandatory)	NC 5	5	10	Internship			
		SEMESTER –VI (29 Cr.)	i) C11 (Th. 4 Cr. + P 2 Cr.) ii) SEC-V & VI iii) DSE-VI iv) GE-III	4 2 4 4 4	4 4 4 4 4	45 10 40 45 45	@SPT – VII @SPT - VII Lab MOOCS (NPTEL) 1.Mobile Computing 2. E-Commerce 3. Real Time System #To be opted from another School	5 5 5 5		
			ii) C12 (Th. 4 Cr. + P 2Cr.)	4 2	4 4	45 10	@SPT – VIII@SPT - VIII Lab	5		
			iii) Research Project iv) Industrial Project (Mandatory)	NC 5	5	10	Industrial Project			

Annexure -2

List of SPT Subjects –

1. Probability Statistics   2. Linux and Administration
3. Machine Learning   4. Artificial Intelligence

Format-3

Format-3

IIMTU-NEPIMPLEMENTATION
Year-I/Semester-I

Programme: Certificate **Class:**BSC CS(DS)		**Year:** I **Semester:**I
Credits Theory:4Cr	**Subject:**Probability & Statistics (SPT-I)	
Course Code: BCS-NEP-111	**Title:**Probability & Statistics (SPT-I)	
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 Course		
Minimum Passing Marks/Credits:40% Marks (ISE+ESE)		
L:4 T:0 P:0(In Hours/Week) Theory-1Hr.=1Credit Practical-2Hrs.=1Credit (4Hrs./Week=4Credits)		

Unit	Contents	No. ofLectures 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 SKEWNESSas Horizontal distortion of Data-Karl. Pearson's coefficient of Skewness, Bowlay's coefficient of Skewness, Skewness by methods of Moments, Defining KURTOSISas 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-	10

	Mutually Exclusive events.	
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 Metrics.	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) Classtasks/Sessional Examination	15
2) Presentations /Seminar	
3) Assignments	10
4) Research Project Report	
5) Semina rOn Research Project Report	
6) 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 metrics.

Format-3

IIMTU NEP-IMPLIMENTATION
Year- I /Semester- I

Programme: Certificate **Class:**BSC CS(DS)		**Year: I** **Semester: I**
Credits Theory:4Cr	**Subject:** Discrete Mathematics	
Course Code: BCS-NEP-104	**Title:**Discrete Mathematics	

CourseObjectives:

- CO1: Identify and prove properties of Algebraic Structures like Groups, Rings and Fields.
- CO2: Formulate and solve recurrences and recursive functions.
- CO3: Apply the concept of combinatorics to solve basic problems in discrete mathematics.
- CO4: Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions.
- CO5: Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic.

Nature of Paper: Discipline Specific Elective

MinimumPassingMarks/Credits:40% Marks (ISE+ESE)

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

Unit	Contents	No. ofLectures Allotted
I	**Set Theory:** Introduction, Size of sets and Cardinals, Venn diagrams Combination of sets, Multi sets, ordered pairs and Set Identities. **Functions:** Definition, Types of functions, Operations on functions, Recursively defined functions. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation.	8
II	**Posets, Hasse Diagram and Lattices:** Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction on flattices, 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	**Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic. **Propositional:** Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection.	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 Nonzero 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 Pigeonhole principle, Polya's Counting theorem.	8

Text Book:

1. Kenneth H.Rosen,"Discrete Mathematics and Its Applications", McGraw Hill, 2006.
2. B. Kolman, R.C Bus by and S.C Ross, "Discrete Mathematics Structures", Prentice Hall,2004.

Reference Book:

1. R.P Girimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley, 2004.
2. Y.N. Singh, "Discrete Mathematical Structures", Wiley-India, First edition, 2010.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 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

IIMTU-NEP IMPLEMENTATION
Year-I/Semester-I

Programme: Certificate **Class:**BSC CS DS	**Year:**I **Semester: I**
Credits Theory:4Cr	**Subject:**Mathematics-I
Course Code: BCS-NEP-104	**Title:**Mathematics-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, Methods of Integration Substitution.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (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, Simple Problems of Line 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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
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-NEPIMPLEMENTATION
Year-I/Semester-I

Programme: Certificate **Class:** BSC CS(DS)		Year: I Semester: I
Credits Theory: 3Cr	**Subject:** English communication	
Course Code: NHU-111	**Title:** English Communication	
Course Objectives: CO1: It aims to improve English communication skills i.e., Listening, speaking, reading, & writing. CO2: To develop potential skills to deal confidently in English with diverse situations in the external world. CO3: To work in a collaborative manner & communicate effectively in English. CO4: To get exposure to various activities related to English Communication which will enable the learners to take initiative, solve problems, and demonstrate a positive work ethics.		
Nature of Paper: AECC		
Minimum Passing Marks/Credits:40% Marks		
L: 3 T: 0 P: 0 (In Hours/Week) Theory - 1 Hr. = 1 Credit		

Unit	Contents	No. of Lectures Allotted
I	English Communication skills: listening skills, speaking skills, reading skills, writing skills**.** Starting and sustaining a conversation. Process of Communication, Essential of effective Communication, Barriers to Communication, Role of Communication.	8
II	Public Speech, Delivering skills, Group discussion, Communication in seminars, Conferences and Committees Parts of Speech- Noun, Pronoun, Adjective, Verb, Adverb, Conjunction, Preposition, Interjection, Articles, Common errors in English	8
III	Presentation: Features, Styles, Use of visual aids, Creating a Dynamic Presentation, Presentation and interaction, Telephonic conversation & Basic Etiquette. Non-Verbal Communication: Meaning, Types and Importance. Listening: Difference between Listening and Hearing	8
IV	Word Skills-Synonyms, Antonyms, Words often Confused, Idioms, Phrases, Phrasal Verbs	8
V	Drafting of Notices, Agendas, Minutes, Job Application letter, CV, Business Correspondence, Essentials of Effective Business Correspondence, Types and Structure of Business Letter.	8

Text Books:

- English Grammar and Composition by Wren & Martin
- Effective Communication and Soft Skills by Nitin Bhatnagar
- The ACE of Soft Skills: Attitude, Communication and Etiquette for Success by Gopalaswamy Ramesh and Mahadevan Ramesh.

Reference

- English Grammar in Use by Raymond Murphy
- English Grammar Composition and Usage by J.C. Nesfield

Evaluation/Assessment Methodology

	Max. Marks 50
1) Class tasks/ Sessional Examination 2) Presentations /Seminar/Attendance 3) Assignments/TA	15
4) Research Project Report Seminar On Research Project Report	Nil
5) ESE	35
Total:	50
Prerequisites for the course: NIL	

Course Learning Outcome:

CO1: To get knowledge about communication skills.
CO2: To understand about use of grammar.
CO3: To understand about presentation.
CO4: To get information about how to face interview and public.
CO5: To get knowledge about telephonic conversation & etiquette.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-I

Programme: Certificate **Class:** BSC CS(DS)	Year: I Semester: I
Credits Theory:4Cr	**Subject:** Problem Solving using C
Course Code: BCS-NEP-101	**Title:** Problem Solving using C

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 concept of Arrays, Pointers, Functions, categories of function and recursion.

CO4: Students will be able to develop 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: 40% Marks (ISE +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 to 'C' Language:** History, C Character Set, Tokens, Keywords, Constants, Identifiers, Variables, Data Types, Comments, Structures of 'C' Program, Introduction to Pre-processor Directives: #include, #define, printf(), scanf(), Declaration, Assignment, Operators, Expressions, Statements, Arithmetic Expressions.	10
II	**Branching and Looping:** Two Way Selection (if, if-else, Nested if-else, cascaded if-else), Switch Statement, Ternary Operator, goto Statement, Loops (for, while, do-while) in C, break and continue Statements, Nested Loops.	10
III	**Arrays**: Types of Arrays, Array Declaration, Array Initialization, Accessing Data from Array, Using Arrays with Functions, Multi-Dimensional Arrays. **Pointers:** Basics, Pointer and Function, Array of Pointers. **Storage Classes:** Automatic, External, Static & Register. **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.	9

IV	**String:** Declaring, Initializing, String Manipulation Functions, String Input and Output Functions, String Pointer, Array of Strings, Passing String to Function. **Structure and Union:** Basic of Structures, Structures and Functions, Array of Structures, Pointer to Structure, Union.	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(), ftell(), feof( ), etc.	8

Text Books:

1. E. Balaguruswamy, "*Programming in ANSI C",* Tata McGraw-Hill Education.
2. YashwantKanetkar, *"Let us C",* BPB Publications

Reference

1. V Rajaraman, "*Computer Basics and C Programming*", PHI Learning
2. 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	
4) Research Project Report	10
5) Seminar On Research Project Report	
6) ESE	75
Total:	100

Prerequisites for the course: NIL

Learning Outcomes:

CO1: Students will be able to develop programs based on fundamental concepts of programming in C. Students will be able to solve problems based on Conditional and Iterative Control Statements.

CO2: Students will be able to learn Complete Programming Concepts of Arrays, Pointers and get familiar with modular programming Concepts of C using Functions.

CO3: Students will be able to learn conceptual programming with String, Structure and its differentiation with Union.

CO4: Students will be able to perform File handling programs with read and write concepts.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I / Semester-I

Program:UG **Class:**BSC CS(DS)	Year:I Semester: I
Credits Theory: 0 Practical:4Cr	**Subject:** Problem Solving using C Lab
Course Code: BCS-NEP-105P	**Title:** Problem Solving using C Lab

Course Objectives:

CO 1: Students will be able to learn the basics of programming language and Fundamental concepts of C Language.
CO 2: Students will be able to learn and understand Concepts of basic programming with Conditional and Iterative Control statements.
CO 3: Students will be familiar with the concept of Arrays, Pointers, Functions, categories of function, and recursion.
CO 4: Students will be able to develop a Program with Structure; learn Union and Complete String Operations.
CO 5: Students will be familiar with File handling programs to perform read-write operations.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks

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.)	
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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	25 25
Total:	50

Course Learning Outcomes:

CO 1: Students will be able to develop programs based on fundamental concepts of programming in

CO 2: 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

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-II

Programme: Certificate **Class:**BSC CS(DS)	**Year:** I **Semester**: II
Credits Theory:4Cr	**Subject:** Linux Administration with Scripting(SPT-II)
Course Code: BCS--NEP-211	**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 (ISE +ESE)

L:4
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	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, 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	15 10 75
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

IIMTU-NEPIMPLEMENTATION
Year-I/ Semester-II

Programme: Certificate **Class:**BSC CS(DS)		**Year:**I **Semester**: II
Credits Theory:3Cr	**Subject:** Environment and Ecology	
Course Code: NHU-112	**Title:** Environment and Ecology	
Course Objectives: CO1:Creating the awareness about environmental problems among people CO2: Imparting basic knowledge about the environment and its allied problems. CO3: Developing an attitude of concern for the environment. CO4: Motivating public to participate in environment protection and environment improvement. CO5: Grasp the significance and issues related to ecosystems, biodiversity and natural resources.		
Nature of Paper: AECC		
Minimum Passing Marks/Credits:40% Marks(ISE+ESE)		
L:3 T:0 P:0(In Hours/Week) Theory-1Hr.=1Credit		

Unit	Contents	No. ofLectures Allotted
I	**The Multidisciplinary Nature Of Environmental Studies:** Definition, Scope and Importance, Need for Public Awareness.	8
II	**Natural Resources:** Renewable And Non-Renewable Resources; **Natural Resources and Associated Problems: -** A. Forest Resources: Use and Over-Exploitation, Deforestation, Case Studies. Timber Extraction, Mining, Dams and Their Effects on Forests and Tribal People. B. Water Resources: Use and Over-Utilization of Surface and Ground Water, Floods, Drought, Conflicts Over Water, Dams-Benefits and Problems. C. Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Case Studies. D. Food Resources: World Food Problems, Changes Caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Case Studies. E. Energy Resources: Growing Energy Needs, Renewable and Non-renewable Energy Sources, Use of Alternate Energy Sources, Case Studies F. Land Resources: Land as a Resource, Land Degradation, Man Induced Landslides, Soil Erosion and Desertification. G. Role of an Individual In Conservation Of Natural Resources; Equitable Use of Resources for Sustainable Lifestyles	8
III	**Ecosystems:**	8

	Concept of an Ecosystem; Structure and Function of an Ecosystem; Producers, Consumers and Decomposers; Energy Flow in the Ecosystem; Ecological Succession; Food Chains, Food Webs and Ecological Pyramids; Introduction, Types, Characteristic Features, Structure And Function of the Following Ecosystem: - A. Forest Ecosystem B. Grassland Ecosystem C. Desert Ecosystem D. Aquatic Ecosystems (Ponds, Streams, Lakes, Rivers, Oceans, Estuaries)	
IV	**Biodiversity and Its Conservation:** Introduction – Definition: Genetic, Species and Ecosystem Diversity; Biogeographical Classification of India; Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, and Aesthetic and Option Values; Biodiversity at Global, National and Local Levels; India as a Mega-Diversity Nation; Hot-Sports of Biodiversity; Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man-Wildlife Conflicts; Endangered and Endemic Species of India; Conservation of Biodiversity: In-Situ and Ex-Situ Conservation of Biodiversity.	8
V	**Environmental Pollution:** Definition, Causes, Effects and Control Measures of Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Nuclear Pollution; Solid Waste Management: Causes, Effects and Control Measures of Urban and Industrial Wastes; Role of an Individual in Prevention of Pollution; Pollution Case Studies; Disaster Management: Floods, Earthquake, Cyclone and Landslides.	8

Text Books:

1. A. Basak, "*Environmental Studies",* Pearson Education.
2. Anil Kumar De, "*Environmental Studies*", New Age International

Reference:

1. J. P. Sharma, "*Environmental Studies*", University Science Press.

Evaluation/Assessment Methodology	
	Max. Marks 50
1) Class tasks/Sessional Examination 2) Presentations /Seminar 3) Assignments 4) Research Project Report 5) Seminar On Research Project Report 6) ESE	15 35
Total:	50

Prerequisites for the course: Nil
Course Learning Outcomes: CO1: Student will be able to recognize the physical and biological components of earth’s system. CO2: Student will be able to examine all environmental issues. CO3: Student will be able to do independent research on human interaction with the CO4: environment. CO5: Student will be able to develop and attitude of concern for the environment. Student will be able to motivate public to participate in environmental protection.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I/Semester-II

Programme: Certificate **Class:**BSC CS(DS)	**Year:**I **Semester:**II
Credits Theory: 4Cr	**Subject:**Mathematics-II
Course Code: BCS-NEP-204	**Title:**Mathematics-II

Course Objectives:

CO 1: Apply mathematical concepts and principles to perform computations.
CO 2: Apply mathematics to solve problems.
CO 3: Create, use and analyse graphical representations of mathematical relationships.
CO 4: Communicate mathematical knowledge and understanding.
CO 5: Apply technology tools to solve problems.

Nature of Paper: DSE

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

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

Unit	Contents	No. of Lectures Allotted
I	**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
II	**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
III	**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
IV	**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	8
V	**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	8

	variables for solving partial differential equations, Solution of one- and two-dimensional wave and heat conduction equations, Laplace equation in two-dimension, Equation of transmission lines.	

Text Books:

1. E. Kreyszig, “Advanced Engineering Mathematics”, JohnWiley& Sons
2. B. V. Ramana, “Higher Engineering Mathematics”, Tata McGraw- Hill Publishing Company Ltd
3. R.K. Jain & S.R.K. Iyenger, “Advance Engineering Mathematics”, Narosa Publishing House.

Reference:

1. H. K. Dass, “Introduction to Engineering Mathematics”, S. Chand, New Delhi
2. R. Wylie, “Advanced Engineering Mathematics”, Mc. Graw-Hill.

Evaluation/Assessment Methodology

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

Prerequisites for the course: Mathematics-I

Course Learning Outcomes:

CO 1: Apply mathematical concepts and principles to perform computations.
CO 2: Apply mathematics to solve problems.
CO 3: Create, use and analyse graphical representations of mathematical relationships.
CO 4: Communicate mathematical knowledge and understanding.
CO 5: Apply technology tools to solve problems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester-II

Programme: Certificate **Class:** BSC CS(DS)	**Year:** I **Semester:** II
Credits Theory:4Cr	**Subject:** Optimization Techniques
Course Code: BCS-NEP-204	**Title:** Optimization Techniques

Course Objectives:

CO1: Enumerate the fundamental knowledge of Linear Programming and DynamicProgramming problems.

CO2: Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function).

CO3: The problem formulation by using linear, dynamic programming, game theory and queuing models.

CO4: The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.

CO5: Formulation of mathematical models for quantitative analysis of managerial problems in industry.

Nature of Paper: DSE

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

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

Unit	Contents	No. of Lectures Allotted
I	**LINEAR PROGRAMMING (L.P):** Revised Simplex Method, Duel simplex Method, Sensitivity Analysis **DYNAMIC PROGRAMMING (D.P):** Multistage decision processes. Concepts of sub optimization, Recursive Relation-calculus method, tabular method, LP as a case of D.P.	8
II	**CLASSICAL OPTIMIZATION TECHNIQUES:** Single variable optimization without constraints, Multi variable optimization without constraints, multivariable optimization with constraints–method of Lagrange multipliers, Kuhn-Tucker conditions. **NUMERICAL METHODS FOR OPTIMIZATION:** Nelder Mead's Simplex search method, Gradient of a function, Steepest descent method, Newton's method.	8
III	**MODERN METHODS OF OPTIMIZATION:** **GENETIC ALGORITHM (GA):** Differences and similarities between conventional and evolutionary algorithms, working principle, Genetic Operators- reproduction, crossover, mutation **GENETIC PROGRAMMING (GP):**	8

	Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, Random population generation. Fuzzy Systems: Fuzzy set Theory, Optimization of Fuzzy systems	
IV	**QUEUING THEORY** Queuing Model, poison and exponential distributions-Queues with combined arrivals and departures-random and series queues.	8
V	**INTEGER PROGRAMMING:** Graphical Representation, Gomory's Cutting Plane Method, Balas' Algorithm for Zero–One Programming, Branch-and-Bound Method. **APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS:** Formulation of model- optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.	8

Text Books:

1. J. K. Sharma, "Operations Research", Macmillan, 5th Edition, 2012.
2. R. Pannerselvan, "Operations Research", 2nd Edition, PHI Publications, 2006.

Reference

1. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education, 2013.
2. Maurice Saseini, ArhurYaspan, Lawrence Friedman, "Operations Research: Methods & Problems",1stEdition, 1959.

Evaluation/Assessment Methodology

Max. Marks 100

1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 appropriate optimization method to solve complex problems involved in various industries.

CO2: Demonstrate the optimized material distribution schedule using transportation model to minimize total distribution cost.

CO3: Find the appropriate algorithm for allocation of resources to optimize the process of assignment.

CO4: Apply the knowledge of game theory concepts to articulate real-world competitive situations to identify strategic decisions to counter the consequences.

CO5: Develop a suitable queuing system to control important performance measures dynamically.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-I/ Semester –II

Programme:UG **Class:**B.SC. CS(DS)	Year: I Semester: II
Credits Practical: 2	**Subject:**Data Structure and algorithm using C Lab
Course Code: BCS-NEP-205P	**Title:**Data Structure and algorithm using C Lab

Course Objectives:
CO1: To Understand and Implement basic Data Structure using C
CO2: To apply Linear and Non Linear Data Structure in Problem Solving.
CO3: To Implement Searching and Sorting Algorithm.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks

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	Basic of Data Structure Programs- Looping, Data Manipulation, array.	2
II	Program using Structures and dynamic Memory allocations.	2
III	Array Implementation of Stacks and queues	2
IV	Linked List Implementation of Stacks and Queues	2
V	Application of Stacks and Queues	2
VI	Implementation of Trees, Tree Traversals	2
VII	Implementation of Binary Search Trees	2
VIII	Implementation of Linear search and Bianry Search	2
IX	Implementation of Insertion Sort,Bubble Sort,Quick Sort and Merge Sort.	2

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:
CO1: Write basic and advanced Program in C using Linear and Non Linear Data Structure.
CO2: Implement Data Structure using C.
CO3: Choose appropriate Sorting Algorithm for an application and implement it in a modularized way.
CO4: Linear data structures and their applications such as Stacks, Queues and Lists and Non-Linear Data Structures and their Applications such as Trees.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- I / Semester- II

Programme:UG **Class:**BSC CS(DS)		Year: I Semester: II
Credits Practical: 2Cr	**Subject:**Linux and administration lab(SPT-II)	
Course Code: BCS-NEP-212P	**Title:**Linux and administration 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.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks

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 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

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	25 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: To understand the concept of client-server communication by using sockets.

Format-3

IIMTU-NEPIMPLEMENTATION
Year-II/ Semester-III

Programme: Diploma **Class:**BSC CS(DS)	**Year:** II **Semester:**III
Credits Theory:4Cr	**Subject:** Data Analytics
Course Code: BCS-NEP-302	**Title:**Data Analytics

Course Objectives:

CO1: Understand item sets, Clustering, frame works & Visualizations.
CO2: Apply R tool for developing and evaluating real time applications.
CO3: Implement various Data streams.
CO4: Understand and apply Data Analysis Techniques.
CO5: Describe the life cycle phases of Data Analytics through discovery, planning and building.

Nature of Paper:DSE

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

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

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, operation alization	8
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 generalization, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	8
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.	8

IV	**Frequent Itemset and Clustering:** Mining frequent item sets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, Clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and Pro CLUS, frequent pattern-based clustering methods, clustering in non-Euclideanspace, clustering for streams and parallelism.	8
V	**Frame Works and Visualization**: Map Reduce, Hadoop, Pig, Hive, HBase, Map R, Sharding, No SQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications.	8

Text Book:

1. John Garrett, "Data Analytics for IT Networks: Developing Innovative Use Cases", Pearson Education.
2. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging
3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley.

Reference Book:

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

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks /Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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 data gathering of large data from a range of data sources.

CO2: Able to Critically analyse existing Big Data datasets and implementations, taking practicality, and usefulness metrics into consideration.

CO3: Able to perform the role of statistics in the analysis of large of datasets.

CO4: Able to apply advanced knowledge of statistical data analytics as applied to large data sets.

CO5: Employ advanced statistical analytical skills to test assumptions, and to generate and present new information and insights from large datasets.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-III

Programme: Diploma **Class:** BSC CS(DS)	Year: II Semester: III
Credits Theory:4Cr	**Subject:** Object Oriented Programming Using Java
Course Code: BCS-NEP-301	**Title:** Object Oriented Programming Using Java

Course Objectives:

CO 1: Able to understand the use of OOPs concepts.
CO 2: Able to solve real world problems using OOP techniques.
CO 3: Able to understand the use of abstraction.
CO 4: Able to understand the use of Packages and Interface in java.
CO 5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks (ISE +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 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, Vectors, Command-Line Arguments.	12
II	Classes, Objects and Methods: Object Class, Defining Class, Adding Variables, Adding Methods, Creating Objects, Constructors, Types of Constructors, this & static keyword, Garbage Collection, Inheritance, Types of Inheritance, Creating Multilevel Hierarchy, Method Over Loading & Overriding, Dynamic Method Dispatching, final keyword, Abstract Class.	12
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. Multithreaded Programming: Thread Life Cycle, Creating Threads, Thread Methods, Thread Priority	12
IV	Managing I/O Files: Introduction, Streams, Stream Classes, File Class,	12

	Creation of Files, Reading and Writing to File, Buffering Files, Random Access Files, Interactive I/O. GUI Programming: GUI Components, AWT, Swings, Event Handling.	
V	Introduction to Applet Programming: Introduction to Applet, Applet Architecture, Applet Life Cycle, Applet Class, Applet Tag, Applet Methods, Running the Applet. JDBC: Accessing Databases with Java Database Connectivity	12

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 Java2, 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	10
Seminar On Research Project Report	
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO 1: Able to understand the use of OOPs concepts.
CO 2: Able to solve real world problems using OOP techniques.
CO 3: Able to understand the use of abstraction.
CO 4: Able to understand the use of Packages and Interface in java.
CO 5: Able to develop and understand exception handling, multithreaded applications with synchronization.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II/Semester-III

Programme: Diploma **Class:**BSC CS(DS)		**Year:**II **Semester:**III
Credits Theory:4Cr	**Subject:** Communication Skill & Personality Development	
Course Code: BCS-NEP-303	**Title:** Communication Skill & Personality Development	

Course Objectives:
CO1: To understand the concept, process and importance of communication.
CO2: To develop skills of effective communication both written and oral.
CO3: To help acquaint with application of communication skills in the world of business.
CO4: To understand the concept of personality and personality development and its significance.
CO5: To understand and develop various traits required for personality development.

Nature of Paper: AECC

Minimum Passing Marks/Credits:40% Marks (ISE +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 Communication** Meaning and Definition, Process, Functions, Objectives, Importance, Essentials of Good Communication, Communication Barriers, Overcoming Communication Barriers.	8
II	**Written Communication:** Need and functions of business letters, Planning and layout of business letters, Advantages and limitations of written communication. **Oral Communication:** Meaning, nature and scope, Principles of Effective Oral Communication, Techniques of Effective Speech, The Art of Listening, Principles of Good Listening, Advantages and Limitations of Oral Communication.	8
III	**Personality Development:** The concept of personality, Dimensions of personality, Term personality development, Significance. **Attitude and Motivation :** Attitude, Concept, Significance, Factors affecting attitudes, Positive attitude, Advantages, Negative attitude, Disadvantages, Ways to develop positive attitude, Difference between Personalities having Positive and Negative Attitude, Concept of motivation, Significance, Internal and external motives, Importance of self-motivation, Factors leading to demotivation.	8
IV	**Self-Esteem:** Term self-esteem, Symptoms, Advantages, Do's and Don'ts to develop positive selfesteem, Low self-esteem, Symptoms, Personality having low self-esteem, Positive andnegative self-esteem. **Interpersonal Relationships**:	8

	Interpersonal relationships, Teaming, Developing positive personality, Analysis of strengths and weaknesses.	
V	**Goal-Setting:** Concept of goal-setting, Importance of goals, Dream Vs goal, why goal-setting fails- SMART (Specific, Measurable, Achievable, Realistic, Time-bound) goals, Art of Prioritisation, Do's and Don'ts about goals. **Essential soft skills Assertiveness -** Lateral thinking - Work ethics, good manners and etiquettes Concept, significance.	8

Text Books:

1. Cloninger, S.C., "Theories of Personality: Understanding Person", Pearson, New York, 2008, 5th edition.
2. Luthans F, "Organizational Behaviour", McGraw Hill, New York, 2005, 12th edition.
3. Barron, R.A. & Brian D, "Social Psychology", Prentice Hall of India, 1998, 8th edition

Reference

1. Adler R.B., Rodman G. & Hutchinson C.C. , "Understanding Human Communication", Oxford University Press : New York, 2011.

Evaluation/Assessment Methodology

Max. Marks 100

1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	50
5) ESE	35
Total:	100

Prerequisites for the course: Problem Solving using C

Course Learning Outcomes:

CO1: Identify different concept of Personality
CO2: Able to Compare and contrast different personal grooming pertains.
CO3: Able to explore communication beyond language.
CO4: Able to manage oneself while communicating.
CO5: Able to acquire good communication skills and develop confidence.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-III

Programme:DIPLOMA **Class:**BSC CS(DS)	**Year:**II **Semester:**III
Credits Theory:4Cr	**Subject:** Computer System Architecture
Course Code: BCS-NEP-302	**Title:** Computer System Architecture

Course Objectives:
CO1: To learn the concepts regarding microprocessor with 8 bit. To learn the concepts regarding Microprocessor with 16 bit.
CO2: To understand the programming techniques of with the help of Assembly Language Programming.
CO3: To understand the basic concept of parallel computing.
CO4: To understand significance of pipelining and parallelism, so that the devices used to perform According to the need of the designer so as to have appropriate results.
CO5: To understand the concepts of Pipeline scheduling theory

Nature of Paper: DSE

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

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

Unit	Contents	No. of Lectures Allotted
I	Basic Computer Organization and Design: Instructions and Instruction Codes, Computer Registers, Timing and Control, Instruction Cycle, Register Transfer and Micro Operations-Registration Transfer Language, Register Transfer Instructions, Bus and Memory Transfer Instructions, Arithmetic and Logic Micro-Operations, Shift Micro-Operations, Arithmetic Logic Shift Unit; Memory-Reference Instructions, Input-Output and Interrupts, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.	8
II	**Central Processing Unit:** General Register Organization, Stacks Organization, Instruction Formats, Addressing Modes, RISC, CISC, Parallel Processing, Pipelining, Instruction and Arithmetic Pipeline, Vector Processing, Matrix Multiplication, Array Processors.	8
III	**Computer Arithmetic:** Addition, Subtraction Algorithms; Multiplication Algorithms: Shift and Add Algorithms, Booth's Algorithm; Divisor Algorithms, Floating Point Representations, Arithmetic Operations on Floating-Point Numbers, Decimal Arithmetic Operations.	8
IV	**Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Mode of Transfer, Priority Interrupts, Direct Memory Address (DMA), Input/ Output Processor (IOP), Serial	8

	Communication.	
V	**Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware	8

Text Books:

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

Reference:

1. Rao, "Prospective in Computer Architecture" , Prentice Hall of India
2. John P. Hayes, "Computer Architecture and Organization", McGraw-Hill.

Evaluation/Assessment Methodology

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

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-III

Programme: Certificate **Class:**BSC CS(DS)	**Year:**II **Semester:**III
Credits Theory:4Cr	**Subject:**Data Structure Algorithms using C
Course Code: BCS-NEP-201	**Title:**Data Structure Algorithms using C

Course Objectives:

CO1: Demonstrate familiarity with major algorithms and data structures.

CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.

CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.

CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and use various data structures effectively in application programs.

CO5: Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks (ISE +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 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, Deques, Priority Queues, Applications of Queue.	8
IV	**Trees:** Introduction and Basic Terminology; Tree Representations as Array &	8

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

Text Books:

1) 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

	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: Demonstrate familiarity with major algorithms and data structures.

CO2: Analyze performance of algorithms and choose the appropriate data structure and algorithm design method for a specified application.

CO3: Determine which algorithm or data structure to use in different scenarios and be familiar with writing recursive methods.

CO4: Demonstrate understanding of the abstract properties of various data structures such as stacks, queues, lists, trees and graphs and Use various data structures effectively in application programs.

CO5: Demonstrate understanding of various sorting algorithms, including bubble sort, insertion sort, selection sort, heap sort and quick sort

Format-3

IIMTU-NEPIMPLEMENTATION
Year-II/Semester-III

Programme: Diploma **Class:**BSC CS(DS)	**Year:**II **Semester:**III
Credits Theory:4Cr	**Subject:** Machine learning
Course Code: BCS-NEP-311	**Title:** **M**achine learning

Course Objectives:

CO1: To understand the basic theory underlying machine learning.

CO2: To understand to formulate machine learning problems corresponding to different applications.

CO3: To understand a range of machine learning algorithms along with their strengths and weaknesses.

CO4: 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 expected accuracy that can be achieved by applying the models.

Nature of Paper: Core Course

Minimum Passing Marks/Credits:40% Marks (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 Python, Python for Data Science, Data Visualisation in Python, Math for Machine Learning.	10
II	Statistics and Exploratory Data Analysis • Exploratory Data Analysis • Cloud Essentials: Intro to Git&Github • Inferential Statistics	10
III	Machine Learning Algorithms Supervised Learning • Regression • Linear Regression • Logistic Regression • Naive Bayes • k-Nearest Neighbours • Support Vector Machine • Decision Tree Models • Unsupervised Learning • K-means clustering	10

	• K-Mode Clustering	
IV	Deep Learning • Introduction to Neural Networks • Convolutional Neural Networks (CNN) • Recurrent Neural Networks (RNN)	10
V	Natural Language Processing • Lexical Processing • Syntactical Processing • Semantic Processing	10

Text Books:

1. Marco Gori , Machine Learning: A Constraint-Based Approach, Morgan Kaufmann. 2017
2. Ethem Alpaydin, Machine Learning: The New AI, MIT Press-2016

Reference:

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	15
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 fundamentals of deep learning.

CO2: Able to design and implement deep neural network systems.

CO3: Able to identify reasonable work goals and estimate their sources required to achieve the objectives.

CO4: Able to apply these techniques in applications which involve perception, reasoning and learning.

CO5: Able to apply topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester –III

Programme:UG **Class:**BSC CS(DS)	**Year:** II **Semester:**I II
Credits Practical: 2	**Subject:** Machine learning Lab (SPT-III)
Course Code: BCS-NEP-312P	**Title:** Machine learning Lab

Course Objectives:
CO1: Design *and evaluate the unsupervised models through python in built functions.*
CO2: Design *various reinforcement algorithms to solve real time complex problems.*
CO3: Design *the code for recommender system using Natural Language processing.*

Nature of Paper: Core

Minimum Passing Marks/Credits: 40% Marks

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 implement k-Nearest Neighbor algorithm	2
II	Apply EM algorithm to cluster a set of data stored in a CSV file.	2
III	Write a program to construct a Bayesian network considering medical data	2
IV	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file.	2
V	Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.	2
VI	Write a program to demonstrate the working of the decision tree based ID3 algorithm.	2
VII	Implement and demonstrate the FIND-S algorithm	2
VIII	implement and demonstrate the Candidate-Elimination algorithm	2

Reference / Text Books:

1. Marco Gori, Machine Learning: A Constraint-Based Approach, Morgan Kaufmann. 2017

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

BOS

Course Learning Outcomes:
Student will be able to:
CO1: Design the unsupervised models through python in built functions
CO2: Understand the basic concepts of reinforcement algorithms.
CO3: Implement various reinforcement algorithms to solve real time complex problems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-IV

Programme:DIPLOMA **Class:**B.SC.CS(DS)	**Year:**II **Semester:**IV
Credits Theory:4Cr	**Subject:**Artificial Intelligence (SPT-IV)
Course Code: BCS-NEP-411	**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 (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	**9**

	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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report Seminar On Research Project Report	10
5) ESE	75
Total:	100

Prerequisites for the course: Artificial Intelligence

Course Learning Outcomes:

CO 1: Learn about Artificial Intelligence, AI tasks and AI problem solving technique.
CO 2: Learn study the concepts Propositional logics, predicate Logic
CO 3: Learn the concepts Semantics Net, Partitions Net, Conceptual Dependencies and Scripts
CO 4: Learn concepts of Prolog and Implement the Prolog Program.
CO 5: Learn concepts of Expert system and Learning.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-IV

Programme: Diploma **Class:**BSC CS(DS)		**Year:** II **Semester:** IV
Credits Theory:4Cr	**Subject:**Data Mining	
Course Code: BCS-NEP-404	**Title:**Data Mining	

Course Objectives:

CO1: To introduce students to basic applications, concepts, and techniques of data mining.
CO2: To develop skills for using recent data mining software to solve practical problems in a variety of disciplines.
CO3: To extract knowledge from data repository for data analysis, frequent pattern, classification and prediction.
CO4: Understand and implement classical models and algorithms in data warehouses and data mining.
CO5: Master data mining techniques in various applications like social, scientific and environmental context.

Nature of Paper: DSE

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

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

Unit	Contents	No. of Lectures Allotted
I	**Introduction:** Data Mining - Overview, Motivation, Definition & Functionalities, Major issues in Data Mining, Integration of Data Mining System with Data Warehouse System. **Data Preprocessing**: Descriptive Data Summarization, Data Cleaning-Missing Values, Noisy Data, Data Integration and Transformation, Data Reduction-Data Cube Aggregation, Attribute Subset Selection, Dimensionality Reduction, Numerosity Reduction, Discretization and Concept Hierarchy.	10
II	**Association Rules:** Introduction, Frequent Item-sets, Closed Item-sets, Methods to Discover Association Rules, Apriori Algorithm, Multilevel Association Rule Mining, and Rule Evaluation Metrics.	10
III	**Classification and Prediction:** Classification Techniques-Decision Tree, Rule-Based Classification, Bayesian Classification, k-Nearest-Neighbor Classifier, Linear Regression, Accuracy and Error Measures	10
IV	**Cluster Analysis:** Introduction, Types of Data, Partitioning Methods- k-Means and k-Medoids, Hierarchical Clustering- Chameleon, Density Based Methods-DBSCAN, OPTICS. Grid Based Methods- STING, Model Based Methods-Neural Network Approach, Outlier Analysis.	10
V	**Recent Trends and Applications:** Web Mining, Spatial Data Mining, Text	10

	Mining, Multimedia Data Mining, Applications of data mining in finance, business, social networks.	

Text Books: 1. Jiawei Han, Jian Pei, Micheline Kamber, *"Data Mining: Concepts and Techniques"*, Elsevier.

Reference:

1. Margaret H. Dunham, "*Data Mining: Introductory and Advanced Topics",* Pearson Education.
2. Arun K. Pujari, *"Data Mining Techniques"*, Universities Press.
3. 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	10
Seminar On Research Project Report	
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO1: Understand the functionality of the various data mining and data warehousing component.
CO2: Appreciate the strengths and limitations of various data mining and data warehousing models.
CO3: Explain the analyzing techniques of various data
CO4: Describe different methodologies used in data mining and data ware housing.
CO5: Compare different approaches of data ware housing and data mining with various technologies.

IIMTU-NEP IMPLEMENTATION
Year-II/ Semester-IV

<table>
<tr><td colspan="2">Programme: Diploma
Class: BSC CS(DS)</td><td colspan="2">Year: II
Semester: IV</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject: Software Engineering</td></tr>
<tr><td>Course Code:
BCS-NEP-401</td><td colspan="3">Title: Software Engineering</td></tr>
<tr><td colspan="4">Course Objectives:</td></tr>
<tr><td colspan="4">CO 1: Select and implement different software development process models.
CO 2: Extract and analyze software requirements specifications for different projects.
CO 3: Develop some basic level of software architecture/design.
CO 4: Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress.
CO 5: Apply different testing and debugging techniques and analyzing their effectiveness.</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE +ESE)</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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</td><td>10</td></tr>
<tr><td>II</td><td colspan="2">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, Behavioral Modeling, Control Specification, Process Specification, Data Dictionary, Software Quality Framework, Quality Metrics for Analysis Model.</td><td>10</td></tr>
<tr><td>III</td><td colspan="2">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,</td><td>10</td></tr>
</table>

	Component-Level Design, Deployment-Level Design, Implementation Issues and Programming Support Environment, Quality Metrics for Design Model and Source Code.	
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.	10
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, Configuration Audit, Metrics for Maintenance.	10

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, 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	
4) Research Project Report	10
Seminar On Research Project Report	
5) ESE	75
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

CO 1: Select and implement different software development process models.
CO 2: Extract and analyze software requirements specifications for different projects.
CO 3: Develop some basic level of software architecture/design.
CO 4: Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress.
CO 5: Apply different testing and debugging techniques and analyzing their effectiveness.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II/Semester– IV

Programme: Diploma **Class:** BSC CS(DS)	**Year:**II **Semester:**IV
Credits Theory:4Cr	**Subject:** Numerical Analysis
Course Code: BCS-NEP-404	**Title:** Numerical Analysis

Course Objectives:

CO1: Basic understanding of numerical Algorithms.

CO2: Adequate exposure to learn alternative methods and analyze mathematical problems to determine the suitable numerical techniques.

CO3: Use the concepts of interpolation, eigen value problem techniques for mathematical problems arising in various fields.

CO4: Solve initial value and boundary value problems which have great significance in engineering practice using ordinary and partial differential equations.

CO5: Demonstrate elementary programming language, implementation of algorithms and computer programs to solve mathematical problems.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (ISE +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:** Numbers representation on a computing machine with particularization to single precision, double precision, quadrupleprecision and the Intel 86 family of processors. Definitions of numerical rounding error and chopping error, Discussion of major sources of error in numerical analysis	8
II	**Solution of algebraic equations:** Description of: Bijection algorithm and its coding; Method of False Position and its coding; The Secant algorithm and its coding; The Newton-Raphson algorithm and its coding. Brief discussion ofthe robustness and relative performance of these algorithms. Properties of the fixed-point algorithm xn+1 = g(xn) given x0.Definition of the Lipshitz condition and the notion of a contraction algorithm. - Conditions for convergence of xn+1 = g(xn),Error estimation for algorithm xn+1 = g(xn),General notion of the order of an iterative algorithm, Aitken acceleration and Steffensen's algorithm,Solution of systems of algebraic equations	8
III	**Numerical Interpolation:** Polynomial interpolation., Definition of the Lagrange interpolating polynomial, Interpolation based on the Lagrange interpolating polynomial, Newton interpolation using divided differences, Error analysis	8

	underlying polynomial interpolation based on, Rolle’s theorem. -The Chebyshev Economization and itsoptimality, Piecewise linear spline, Subpoint quadratic spline, Construction of the cubic spline, Least-squares data fitting; its use and implementation	
IV	**Solution of linear equations:** Concept of Gaussian elimination, the concept of pivoting and asimple illustration of why pivoting is needed,LU factorization of matrices with and without partial/full pivoting, The Choleski factorization, Matrix inversionIterative methods,The concept of a matrix norm with simple examples, e.g. the Frobenius norm, The Jacobi iteration algorithm,The Gauss-Seidel algorithm, The Gauss-Seidel algorithm with over-relaxation	8
V	**Numerical calculation of matrix eigenvalues:**Gershgorin’s theorem with an example - The Power algorithm, The Inverse Power algorithm, The Jacobi transformation, The Householder transformation, Construction of the Upper Hessenberg matrix, The QR algorithm	8

Text Books:

1. V. A. Patel. Numerical Analysis. Harcourt Brace, College Publishers, 1994.
2. W. Cheney and D. Kincaid. Numerical Mathematics and Computing. Brooks/ColePublishing Company, 2003.

Reference

1. Numerical Analysis. 9thed. R.L. Burden and J.D. Faires: EditionBrooks / cole: -73563-538-0-978 .2011136.
2. An Introduction to Numerical Analysis. Endre Süli, David F. Mayers Cambridge : -0521810264 -2003 .0521007941

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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: Discuss robustness and relative performance of different algorithm.
CO2: Able to apply interpolation methods for solving the problems numerically.
CO3: Able to calculate the errors and the rates of convergence.
CO4: Able to evaluate the relationships between different areas of mathematics and the connections between mathematics and other disciplines.
CO5: Able to develop numerical algorithms for the s olution of the algebraic eigen value problem.

Format-3

IIMTU-NEP IMPLEMENTATION
Year-II / Semester-IV

Programme: Certificate/Diploma/Degree/ UG(R)/PG/Ph.D.Certificate **Class:**All UG Classes of IIMT University	Year: II Semester:IV
Credits Theory- 3Cr	**Subject:**Human values and professional ethics
Course Code Theory UVE-401	**Title:**Human values and professional ethics

Course Objectives:

CO1: To reinstate the rich cultural legacy and human values of which we are the custodians.

CO2: To focus on professional ethics which are broader indicators of desirable actions vis-à-vis undesirable actions.

CO3: To lay down broader guidelines of values and ethics for internal and external stakeholders.

CO4: To suggest operational guidelines for value-based and ethical practices in the higher educational institutions leading to implementation and monitoring.

CO5: To indicate the outcomes of creating a value-based and ethical culture in HEIs.

CO6: To suggest indicative reinforcement programmes for nurturing human values and ethics in HEIs.

Nature of Paper: Core/DSE/SEC/GE/AECC-AECC

Minimum Passing Marks/Credits:40% Marks

L:3
T:0
P: 0 (In Hours/Week)
Theory - 1 Hr. = 1 Credit

Unit	Contents(Theory)	No. of Lectures Allotted
I	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education	6
II	Understanding Harmony in the Human Being - Harmony in Myself	6
III	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship	6
IV	Understanding Harmony in the Nature and Existence - Whole existence as Co-existence	6
V	Implications of the above Holistic Understanding of Harmony on Professional Ethics	6

Suggested Readings: For Theory

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, JeevanVidya Ek Parichay, Divya Path Sansthan, Amarkantak.

6. P L Dhar, RR Gaur, 1990, Science and Humanism, Common wealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers , Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted2008.
13. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and ProfessionalEthics.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	10 marks
2) Presentations /Seminar	05 marks
3) Assignments	NA
4) Research Project Report	NA
Seminar On Research Project Report	35
5) ESE	
Total:	15+35 Internal+External

Prerequisites for the course: First year must be clear for appearing in IIIrd/IVth for the study of this Audit/Qualifying course**- for theory**

Second year must be clear for appearing in VithSem for the study of this audit/Qualifying Course **- for theory**

Course Learning Outcomes:

CO1: The learning process for holistic development.

CO2: Impeccable governance.

CO3: Effective institutional management.

CO4: Well laid system of rewards and chastisement.

CO5: Institutional climate where ‘rights’ enjoy and ‘wrongs’ are discouraged.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester –IV

Programme: UG **Class:**BSC CS(DS)	Year:II Semester:IV
Credits Practical: 2Cr	**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:40% Marks

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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	25
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.

Format-3

IIMTU-NEP IMPLEMENTATION
Year- II / Semester- IV

Programme: UG **Class:**BSC CS(DS)	**Year:**II **Semester:**IV
Credits Practical: 2Cr	**Subject:**Software Engineering Lab
Course Code: BCS-NEP-405P	**Title:**Software Engineering Lab

Course Objectives:
CO1: Understand and Describe basic concept of UML, design, implementation of test cases and OOP concepts using java
CO2: Discuss and Analyses how to develop software requirements specifications for a given problem.
CO3: Explain and build DFD models
CO4: Understand and develop various structure and behavior UML diagrams.
CO5: Explain the knowledge of project management tool Demonstrate how to manage file using Project Libre project management tool.

Nature of Paper: Core

Minimum Passing Marks/Credits:40% Marks

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	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, Design Documents and	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.	

Reference / Text Books:
1. RS Pressman, Software Engineering: A Practitioners Approach, McGraw Hill.
2. PankajJalote, Software Engineering, Wiley
3. Rajib Mall, Fundamentals of Software Engineering, PHI Publication.

4. KK 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	
5) Seminar On Research Project Report	
6) ESE	25
Total:	50
Course Learning Outcomes: **Student will be able to:** CO1: Draw a class diagram after identifying classes and association among the CO2: Graphically represent various UML diagrams, and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially CO3: Able to use modern engineering tools for specification, design, implementation and testing CO4: Develop test cases for various white box and black box testing techniques.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year-III/ Semester-V

Programme: Degree **Class:**BSC CS(DS)	**Year:**III **Semester:**V
Credits Theory:4Cr	**Subject:**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 Practicaloriented 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 (ISE +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: McGraw-Hill

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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

<table>
<tr><td colspan="2">Programme:Degree
Class:BSC CS(DS)</td><td colspan="2">Year: III
Semester:V</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject: Big Data</td></tr>
<tr><td>Course Code:
BCS-NEP-503</td><td colspan="3">Title:Big Data</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">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, Avroand file-based data structures. Hadoop Environment: Setting up a Hadoop cluster, cluster specification, cluster setup and installation, Hadoop</td><td>8</td></tr>
</table>

	configuration, security in Hadoop,	
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. **NoSQL** Databases: Introduction to NoSQL 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, Hbasevs 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 toInfo sphere, BigInsights 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 & SonsPete Warden, "Big Data Glossary", O'Reilly

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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-NEP IMPLEMENTATION
Year-III/ Semester-V

Programme: Degree **Class:**BSC CS(DS)	**Year:**III **Semester:**V
Credits Theory:4Cr	**Subject:**Data Science(SPT-V)
Course Code: BCS-NEP-511	**Title:**Data Science(SPT-V)

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 (ISE +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 distributions - Theoretical Distribution -	8

	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, An and 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, MichelineKamber 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 2) Presentations /Seminar 3) Assignments	15
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-NEPIMPLEMENTATION
Year-III/ Semester-V

Programme: Certificate **Class:** BSC CS(DS)	**Year:**III **Semester:**V
Credits Theory:4Cr	**Subject:** 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 (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: 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	10
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.	10
III	Transport Layer: Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services,	10
IV	Network layer: Logical Addressing, Internetworking, Address mapping, ICMP, IGMP, Forwarding, Uni-Cast Routing Protocols, Multicast Routing Protocols.	10
V	Application Layer: Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.	10

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 2) Presentations /Seminar 3) Assignments	15
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:UG **Class:**BSc CS (DS)	Year: III Semester: V
Credits Practical: 2Cr	**Subject:** Data Science Lab (SPT- V)
Course Code: BCS-NEP-512P	**Title :**Data Science Lab (SPT- V)

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:40% Marks

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) 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-NEP IMPLEMENTATION
Year/-III / Semester-VI

Programme: Degree **Class:**BSC CS(DS)		**Year:**III **Semester:**VI
Credits Theory:4Cr	**Subject:**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 (ISE +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.SimpleImputer), multivariate feature imputation, nearest neighbors imputation (sklearn.impute.KNNImputer), 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 and yahoo finance, accessing remote data with pandas-datareader, Quandl, and	8

	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, DreamTech Publications.

Evaluation/Assessment Methodology

Max. Marks 100

1) Class tasks/ Sessional Examination 2) Presentations /Seminar 3) Assignments	15
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(DS)	**Year:**III **Semester:**VI
Credits Theory:4Cr	**Subject:**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 (ISE +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 Networks, 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,	8

	Modern Payment Cash, Electronic Cash	
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 2) Presentations /Seminar 3) Assignments	15
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 Theory:4Cr	**Subject:** 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 (ISE +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	15
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 Theory:4Cr	**Subject:**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 (ISE +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 forHard Real Time System.	8
V	**REAL-TIME MODELING AND CASE STUDIES :** Petrinets and applications in real-time modeling, 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	10
4) Research Project Report	
5) Seminar On Research Project Report	
6) 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:UG **Class:**BSc CS (DS)	Year: III Semester: VI
Credits Practical: 2Cr	**Subject:**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:40% Marks

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 Num Py Array a. Dimensions of NumPy array b. Shape of Num Py array c. Size of Num Py array d. Reshaping a Num Py array	2
III	Expanding and Squeezing a Num Py Array a. Expanding a Num Py array b. Squeezing a Num Py array c. Sorting in Num Py Arrays	2
IV	Perform following operations using pandas a. Creating data frame 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	2

	c. Excel files 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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	25
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.

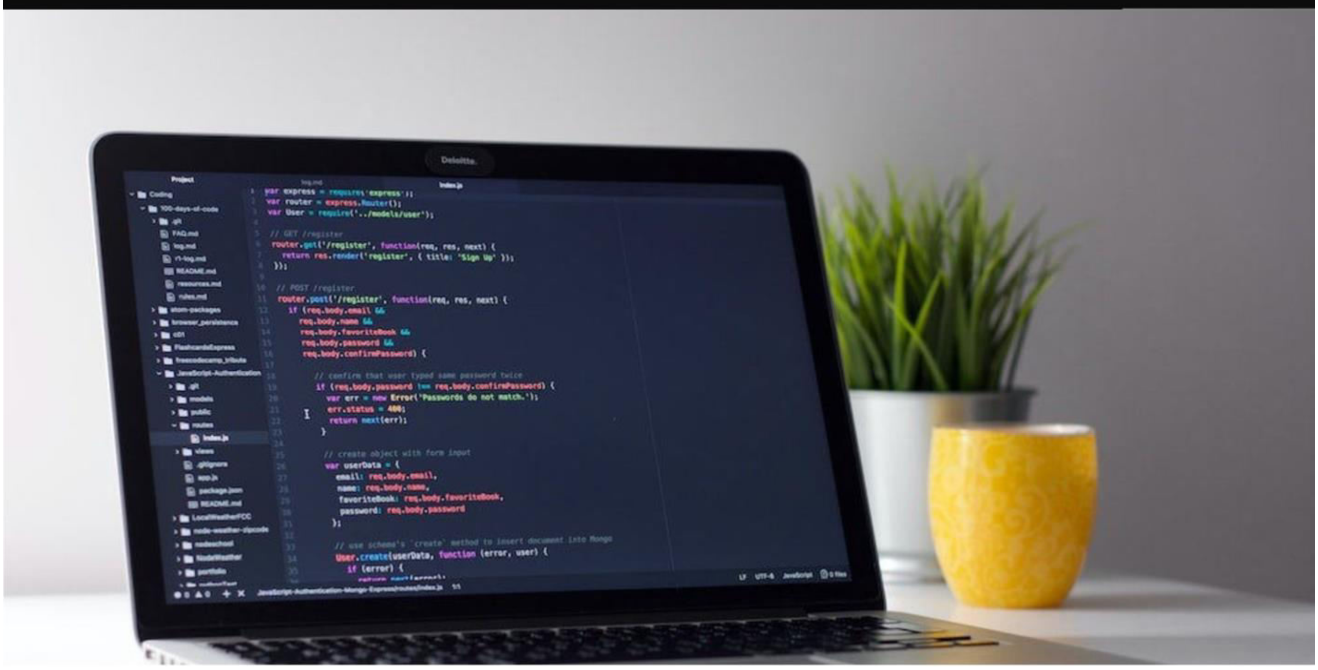
CO4: Show the results and present them in a pictorial format.

IIMT UNIVERSITY
MEERUT (U.P.)
Transforming Education System, Transforming Lives

UGC Approved
Section 2f & 12B

School of Computer Science & Applications

ACADEMIC HAND BOOK



Ordinance & Academic Regulations
For Master of Computer Applications (MCA)
(Established by Govt. of U.P. Vide U.P act No.32 of 2016)
(Effective from the Session: 2022-23)

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 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) 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.

$$\text{SGPA } (S_i) = \Sigma(C_i \text{ x } G_i) / \Sigma C_i$$

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.

$$\textbf{CGPA} = \Sigma\ (C_i \text{ x } S_{i)} / \Sigma\ C_i$$

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

(a) Has passed 1st to 4th (students joining from 1st semester) semester in all the subjects in first attempt only

(b) 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 students 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 theorymarks.

(b) Practical:

(iii) Two mid-term viva-voce/tests of equal weightage 30%of total Practical marks.

(iv) 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 andCentrallegislationsprovidestringentpunishmentsincludingimprisonment.Oncetheinvolvementofastudent(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.

Format-3

IIMTUNIVERSITY
Year – I /Semester – I

Programme:Degree **Class:MCA**		**Year: I** **Semester: I**
Credits **Theory**:4Cr	**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: Compareandcontrastfeatures,functioning&typesofoperatingsystemandcomputernetworks CO4: Demonstratearchitecture,functioning&servicesoftheInternetandbasicsofmultimedia. CO5: IllustratetheemergingtrendsandtechnologiesinthefieldofInformationTechnology.		
Nature of Paper: CORE COURSE		
Minimum Passing Marks/Credits:40% Marks		
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,WebBrowsers. **Internet of Things (IoT):** Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.	8
IV	**Blockchain:** Introduction, overview, features, limitations and application areas	8

	fundamentals of Block Chain. **Crypto currencies:** Introduction, Applications and use cases. **Cloud Computing:** It nature and benefits, AWS, Google, Microsoft & IBM Services	
V	**Emerging Technologies:** Introduction, over view, features, limitations and application areas of Augmented Reality, Virtual Reality, Grid computing, Greencomputing, Big data analytics, Quantum Computing and Brain Computer Interface.	8

Text Books:

1. RajaramanV.,"FundamentalsofComputers",Prentice-HallofIndia.
2. NortonP.,"IntroductiontoComputers",McGrawHillEducation.
3. GoelA.,"ComputerFundamentals",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 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: 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 Theory:4Cr	**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

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 nestedif-else statements, Switch statements, Restrictions on switch values, Use of break and default withs witch, 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 functions.	8
III	**Arrays:** Array notation and representation, Declaring one-dimensionalarray, Initializing arrays, Accessing array elements, Manipulating arrayelements, Arrays of unknown or varying size, Two-dimensional arrays, Multi	8

	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.	
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 UsC”, 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 FreeC”, University Science Press.
2. Gottfried B.,“Schaum’s Outlines-Programmingin 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 Theory:4Cr	**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

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, Deligation.	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, Lateralor 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. **Technical Proposal:** Parts; Types; Writing of Proposal; Significance. Nuances of Delivery; Body Language; Dimensions of Speech: Syllable;	8

	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 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: 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 oneself 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 Theory:4Cr	**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

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 Booleanalgebra, Boolean functions. Simplification of Boolean functions, Karnaughmaps, 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 groups, Homomorphism and Isomorphism of groups.	8

	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 Line arrecurrencerelation 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 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: 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.

IIMT UNIVERSITY
Year – I /Semester – I

<table>
<tr><td colspan="2">Programme: Degree
Class:MCA</td><td>Year: I
Semester: I</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="2">Subject: Computer Organization & Architecture</td></tr>
<tr><td>Course Code:
MCA - 115</td><td colspan="2">Title: Computer Organization & Architecture</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td colspan="3">Nature of Paper: CORE COURSE</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="3">L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
</table>

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 oper 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 optical disks Virtual memory: concept implementation.	8

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. Tannen baum, "Structured Computer Organization", PHI.

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: 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

IIMT UNIVERSITY
Year- I / Semester –I

Program: Degree **Class: MCA**	Year: I Semester: I
Credits 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

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", McGraw Hill.
- 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

Program: Degree **Class: MCA**	Year: I Semester: I
Credits 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

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 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 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

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject: Theory of automata and formal languages</td></tr>
<tr><td>Course Code: MCA - 121</td><td colspan="3">Title: Theory of automata and formal languages</td></tr>
<tr><td colspan="4">Course Objectives:
CO1: Define various types of automata for different classes off or mallanguages and explain their working.
CO2: State and provekey 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-Turingthesis and concept of Undesirability.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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, Myhill-Nerode Theorem, Simulation of DFA and NFA.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">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</td><td>8</td></tr>
</table>

	CFG 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,3rdEdition

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. 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: 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.

IIMT UNIVERSITY
Year – I /Semester – II

Programme: Degree **Class: MCA**	**Year: I** **Semester: II**
Credits Theory:4Cr	**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	
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, thread groups. Generic Programming: Generic classes, generic methods, Bounded Types: Restrictions and Limitations.	8

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", McGraw 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 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: 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 Theory:4Cr	**Subject:** Operating system
Course Code: **MCA - 123**	**Title :**Operating system
Course Objectives: CO 1: 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	
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 buffering, Disk storage and disk scheduling, RAID. File System: File concept,	8

	File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.	

Text Books:

1. Silberschatz, Galvinand 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", 6^{th} Edition, Pearson Education.

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: 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.

IIMT UNIVERSITY
Year-I / Semester-II

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject:DATA BASE MANAGEMENT SYSTEM</td></tr>
<tr><td>Course Code:
MCA- 124</td><td colspan="3">Title:DATA BASE MANAGEMENT SYSTEM</td></tr>
<tr><td colspan="4">Course Objectives:
CO 1: Explain the concept of features of a database system and its application and compare various types of data models.
CO 2: Describe the E-R Models and Relational Database.
CO 3: Explain the concept of SQL Commands, relational algebra, tuple calculus and domain calculus.
CO 4: Explain the need of normalization and normalize a given relation to the desired normal form.
CO 5: Analyze the different approaches of transaction processing and concurrency control.</td></tr>
<tr><td colspan="4">Nature of Paper: CORE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">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</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">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,</td><td>8</td></tr>
</table>

	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", 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 2) Presentations /Seminar 3) Assignments	20
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 Theory:4Cr	**Subject:**Data structure and analysis of algorithms
Course Code: MCA- 125	**Title:**Data structure and analysis of algorithms

Course Objectives:

CO 1: Explain the concept of data structure, abstract data types, algorithms, analysis of algorithms and basic data organization schemes such as arrays and linked lists.

CO 2: Describe the applications of stacks and queues and implement various operations on the musing arrays and linked lists.

CO 3: Describe the properties of graphs and trees and implement various operations such as searching and traversal on them.

CO 4: Compare incremental and divide-and-conquer approaches of design in gal gorithms for problems such assorting and searching.

CO 5: 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

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, Array and Linked Implementation of Stack in C, Application of stack: Prefix and	8

	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, ConnectedComponent.	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 BTree.	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 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: 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: 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

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 indexOutOfBounds 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 2) Presentations /Seminar 3) Assignments 4) Research Project Report/Seminar On Research Project Report 5) ESE	20 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 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

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 (EmpNo, 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 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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report 5) ESE	20 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 Theory:4Cr	**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 (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	10
5. Seminar On Research Project Report	
6. 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

<table>
<tr><td colspan="2">Programme:Degree
Class:MCA</td><td>Year: II
Semester:III</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="2">Subject:Software Engineering</td></tr>
<tr><td>Course Code:
MCA-232</td><td colspan="2">Title:Software Engineering</td></tr>
<tr><td colspan="3">CourseObjectives:
CO1: Explain various software characteristics and analyze different softwareDevelopment 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 toolsfordevelopment, maintenance and analysis.</td></tr>
<tr><td colspan="3">Nature of Paper: Core Course</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="3">L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
</table>

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. Classtasks/SessionalExamination	15
2. Presentations /Seminar	
3. Assignments	
4. Research Project Report	10
5. Seminar On Research Project Report	
6. 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 Theory:4Cr	**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, subnetting 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 ofcryptography and network security.

Nature of Paper: Core Course

Minimum Passing Marks/Credits:40% Marks (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 Switching.	**08**

	Logicaladdressing: IPv4 and IPv6 Address schemes, Classes and subnetting **Network Layer Protocols:** ARP, RARP, BOOTP and DHCP **Routing Techniques:** Interdomain and Intradomain routing with examples.	
IV	**Transport Layer:** **Introduction to Transport Layer**: Process-to-ProcessDelivery: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", McGraw 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. Behrou zForouzan, "TCP/IP Protocol Suite", McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Classtasks/Sessional Examination 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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.

IIMT UNIVERSITY
Year-II/Semester-III

Programme: Degree **Class:**MCA	**Year:** II **Semester:** III
Credits Theory:4Cr	**Subject:** Cryptography & Network Security
Course Code: MCA-011	**Title:**Cryptography & Network Security

CourseObjectives:

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 (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", McGraw Hill.

Reference Book:
1. Kahate A., "Cryptography and Network Security", Tata McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Classtasks/Sessional Examination 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report 5) Seminar On Research ProjectReport	10
6) 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 threatsin the networks.

Format-3

IIMT UNIVERSITY
Year-II/Semester-III

Programme: Degree **Class:**MCA	**Year:** II **Semester:**III
Credits Theory:4Cr	**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.
Explain process of knowledge discovery in database (KDD). Design Data
CO5: Mining model.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (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	**08**

	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 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, DolfZantinge, "Data-Mining", Pearson Education

Evaluation/Assessment Methodology

	Max. Marks 100
1. Classtasks/Sessional Examination	15
2. Presentations /Seminar	
3. Assignments	
4. Research Project Report	10
5. Seminar On Research Project Report	
6. 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

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: II
Semester: III</td></tr>
<tr><td colspan="2">Credits
Theory:4Cr</td><td colspan="2">Subject: Software Project Management</td></tr>
<tr><td colspan="2">Course Code:
MCA-013</td><td colspan="2">Title: Software Project Management</td></tr>
<tr><td colspan="4">CourseObjectives:
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.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>II</td><td colspan="2">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 estimationtechniques–COSMICFullfunctionpoints–COCOMOII–aParametricProductivity Model.</td><td>08</td></tr>
<tr><td>III</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>IV</td><td colspan="2">Project Management and Control: Framework for Management and control–Collectionofdata–Visualizingprogress–Costmonitoring–EarnedValueAnalysis– Prioritizing Monitoring – Project tracking – Change control SoftwareConfiguration Management – Managing contracts –</td><td>08</td></tr>
</table>

	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 – DispersedandVirtualteams–Communicationsgenres–Communicationplans– Leadership.	**08**

Text Book:

1. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management" – Fifth Edition, McGraw 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" – McGraw Hill Education (India), FourteenthReprint2013.

Reference Book:

1. Koontz Harold &Weihrich Heinz, "Essentials of Management", McGraw Hill 5thEdition2008.
2. Robbins and Coulter, "Management", Prentice Hall of India, 9thedition.
3. James A. F., Stoner, "Management", Pearson Education Delhi.
4. P. D. Chaturvedi, "Business Communication", Pearson Education.

Evaluation/Assessment Methodology	
	Max. Marks 100
1. Classtasks/SessionalExamination 2. Presentations /Seminar 3. Assignments	15
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:4Cr	**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 computeand 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 (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	**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 press2011.
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 McGraw-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 2. Presentations /Seminar 3. Assignments	15
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.

IIMT UNIVERSITY
Year-II/Semester-III

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: II
Semester: III</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject: Compiler Design</td></tr>
<tr><td>Course Code:
MCA-015</td><td colspan="3">Title: Compiler Design</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>II</td><td colspan="2">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 parsingtables.</td><td>08</td></tr>
<tr><td>III</td><td colspan="2">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, translation of assignment statements, Boolean expressions, statements that</td><td>08</td></tr>
</table>

	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 McGraw-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 LeBlanc,” Crafting a Compiler.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Classtasks/Sessional Examination	15
2. Presentations /Seminar	
3. Assignments	
4. Research Project Report	10
5. Seminar On Research Project Report	
6. 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.
Represent language tokens using regular expressions, context free grammar and finite
CO2: automata and design lexical analyzer for a language.
Compare top down with bottom up parsers, and develop appropriate parser to produce parse
CO3: tree representation of the input.
Generate intermediate code for statements in high level language.
CO4: Design syntax directed translation schemes for a given context free grammar. generation and
CO5: techniques used for code optimization.

Format-3

IIMT UNIVERSITY
Year-II/Semester-III

Programme: Degree **Class:** MCA	**Year: II** **Semester:** III
Credits Theory:4Cr	**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 (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 2. Presentations /Seminar 3. Assignments	15
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:4Cr	**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 NoSQL 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 (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 processesand 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 Reducefeatures, 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: Setting up a Hadoop cluster, cluster specification, cluster setup and	**08**

	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. **NoSQL** Databases: Introduction to NoSQL 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 metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries. **HBase**– Hbase concepts, clients, example, Hbasevs 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.	**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", PrenticeHall.
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. Classtasks/Sessional Examination 2. Presentations /Seminar 3. Assignments	15
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:4Cr	**Subject:**Simulation and Modelling	
Course Code: MCA-023	**Title:** Simulation and Modelling	

CourseObjectives:
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 dynamicsdiagrams.
CO5: Finding critical path computation and understanding PERT networks

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (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. Classtasks/SessionalExamination 2. Presentations /Seminar 3. Assignments 4. ResearchProjectReport 5. SeminarOnResearchProjectReport 6. 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 Theory:4Cr	**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 (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 affect 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. RenuRajani, Pradeep Oak, “Software Testing – Effective Methods, Tools and Techniques”, Tata McGrawHill.
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. Classtasks/Sessional Examination	15
2. Presentations /Seminar	
3. Assignments	
4. Research Project Report	10
5. Seminar On Research Project Report	
6. 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

CO5: Software 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 Theory:4Cr	**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 spatialand 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 ROIextraction.
CO5: Explain compression techniques and descriptors for image processing.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (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, Third 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. Classtasks/Sessional Examination	15
2. Presentations /Seminar	
3. Assignments	
4. Research Project Report	10
5. Seminar On Research Project Report	
6. 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 Theory:2Cr	**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 (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 Bayesiannet work.	**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”, PearsonEducation.
2. Rich E. and Knight K., “Artificial Intelligence”, McGraw Hill Publications.

Reference Book:
Book:

1. Khemani D., “A First Course in Artificial Intelligence”, McGrawHill.

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	25 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 Semisupervised 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

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: II
Semester: III</td></tr>
<tr><td>Credits
Theory:2Cr</td><td colspan="3">Subject: Software Engineering Lab</td></tr>
<tr><td>Course Code:
MCA-232P</td><td colspan="3">Title: Software Engineering Lab</td></tr>
<tr><td colspan="4">Course Objectives:</td></tr>
<tr><td>CO1:</td><td colspan="3">Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement.</td></tr>
<tr><td>CO2</td><td colspan="3">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.</td></tr>
<tr><td>CO3:</td><td colspan="3">Draw a class diagram after identifying classes and association among them.</td></tr>
<tr><td>CO4:</td><td colspan="3">Graphically represent various UML diagrams and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially.</td></tr>
<tr><td>CO5:</td><td colspan="3">Able to use modern engineering tools for specification, design, implementation and testing.</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 50% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:0
T:0
P:4(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td rowspan="10"></td><td colspan="2">1. Prepare a SRS document in line with the IEEE recommended standards.</td><td>02</td></tr>
<tr><td colspan="2">2. Draw the use case diagram and specify the role of each of theactors.</td><td>02</td></tr>
<tr><td colspan="2">3. Prepare state the precondition, post condition and function of each use case.</td><td>02</td></tr>
<tr><td colspan="2">4. Draw the activitydiagram.</td><td>02</td></tr>
<tr><td colspan="2">5. Identify the classes. Classify them as weak and strong classes and drawthe class diagram.</td><td>02</td></tr>
<tr><td colspan="2">6. Draw the sequence diagram for any two scenarios.</td><td>02</td></tr>
<tr><td colspan="2">7. Draw the collaboration diagram.</td><td>02</td></tr>
<tr><td colspan="2">8. Draw the state chart diagram.</td><td>02</td></tr>
<tr><td colspan="2">9. Draw the component diagram.</td><td>02</td></tr>
<tr><td colspan="2">10. Draw the deployment diagram.</td><td>02</td></tr>
<tr><td colspan="4">Text Book:
1. R S Pressman, “Software Engineering: A Practitioners Approach”, McGraw Hill.
2. Pankaj Jalote, “Software Engineering”, Wiley</td></tr>
<tr><td colspan="4">Reference Book:
Book:
1. Ghezzi, M. Jarayeri, D. Manodrioli, “Fundamentals of Software Engineering”, PHI Publication.
2. Ian Sommerville, “Software Engineering”, Addison Wesley.</td></tr>
</table>

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	25 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.

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UGC Approved Section 2f & 12B

Format-3

IIMT UNIVERSITY
Year-II/Semester-IV

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: II
Semester: IV</td></tr>
<tr><td>Credits
Theory:3Cr</td><td colspan="3">Subject :Privacy and Security in Online Social Media</td></tr>
<tr><td>Course Code:
MCA-031</td><td colspan="3">Title: Privacy and Security in Online Social Media</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>II</td><td colspan="2">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 net works; Phishing in OSM & Identifying fraudulent entities in online social networks</td><td>08</td></tr>
<tr><td>III</td><td colspan="2">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</td><td>08</td></tr>
<tr><td>IV</td><td colspan="2">Identity Management in Online Social Networks: Identity Management, Digital Identity, Identity Management Models: From Identity 1.0 to Identity</td><td>08</td></tr>
</table>

	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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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

<table>
<tr><td colspan="2">Programme:Degree
Class:MCA</td><td>Year: II
Semester: IV</td></tr>
<tr><td>Credits
Theory:3Cr</td><td colspan="2">Subject:Soft Computing</td></tr>
<tr><td>Course Code:
MCA-032</td><td colspan="2">Title:Soft Computing</td></tr>
<tr><td colspan="3">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.</td></tr>
<tr><td colspan="3">Nature of Paper: DSE</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="3">L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
</table>

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-organizingfeature 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, Defuzzification, Types of inference engines.	**08**

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”, PHILearning.
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. andMizutani E., “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Classtasks/SessionalExamination	20
2. Presentations /Seminar	
3. Assignments	
4. ResearchProjectReport	10
5. SeminarOnResearchProjectReport	
6. 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 Theory:3Cr	**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 (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, Fuzzyclassification.	**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 5. Seminar On Research Project Report 6. 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.

IIMT UNIVERSITY
Year-II/Semester-IV

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: II
Semester: IV</td></tr>
<tr><td>Credits
Theory:3Cr</td><td colspan="3">Subject: Data Analytics</td></tr>
<tr><td>Course Code:
MCA-034</td><td colspan="3">Title: Data Analytics</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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</td><td>08</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>III</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>IV</td><td colspan="2">Frequent Itemsets and Clustering: Mining frequent itemsets, market based</td><td>08</td></tr>
</table>

	modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets 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, NoSQL 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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:3Cr	**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 (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-Interscience, 2005; ISBN 0-471- 71345 -7
2. Metrics and Models in Software Quality Engineering, Stephen H. Kan, AddisonWesley (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 2. Presentations/Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:4Cr	**Subject:** Block chain Architecture	
Course Code: MCA-041	**Title:** Block chain Architecture	

Course Objectives:
CO1: Study and understand basic concepts of blockchain architecture.
CO2 Analyze various requirements for consensus protocols.
CO3: Apply and evaluate the consensus process.
CO4: Understand the concepts of Hyperledger fabric.
CO5: Analyze and evaluate various use cases in financial software and supply chain.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (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 Blockchain:** Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. **Blockchain Architecture and Design:** Basic crypto primitives: Hash, Signature, Hashchain to Blockchain, Bitcoin Basic, Basic consensus mechanisms.	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols, distributed consensus, consensus in Bitcoin. **Permissioned Blockchains:** Design goals, Consensus protocols for Permissioned Blockchains	**08**
III	**Hyperledger Fabric:** Decomposing the consensus process, Hyperledger fabric components. **Chaincode Design and Implementation Hyperledger Fabric:** Beyond Chaincode: fabric SDK and Front End, Hyperledger composer tool.	**08**
IV	**Use case 1:** Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv)Insurance. **Use case 2:** Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.	**08**
V	**Use case 3:** Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems, Blockchain Cryptography, Privacy and Security on Blockchain	**08**

Text Book: 1. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies",O'Reilly 2. Melanie Swa, "Blockchain",O' Reilly	
Reference Book: 1. "Hyperledger Fabric",https://www.hyperledger.org/projects/fabric 2. Bob Dill, David Smits, "Zero to Blockchain - 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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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.	

IIMT UNIVERSITY
Year-II/Semester-IV

Programme: Degree **Class:** MCA		**Year: II** **Semester: IV**
Credits Theory:4Cr	**Subject:** Blockchain Architecture	
Course Code: MCA-041	**Title:** Blockchain Architecture	

Course Objectives:

CO1: Study and understand basic concepts of blockchain architecture.
CO2 Analyze various requirements for consensus protocols.
CO3: Apply and evaluate the consensus process.
CO4: Understand the concepts of Hyperledger fabric.
CO5: Analyze and evaluate various use cases in financial software and supply chain.

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (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 Blockchain:** Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. **Blockchain Architecture and Design:** Basic crypto primitives: Hash, Signature, Hashchain to Blockchain, Bitcoin Basic, Basic consensus mechanisms.	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols, distributed consensus, consensus in Bitcoin. **Permissioned Blockchains:** Design goals, Consensus protocols for Permissioned Blockchains	**08**
III	**Hyperledger Fabric:** Decomposing the consensus process, Hyperledger fabric components. **Chaincode Design and Implementation Hyperledger Fabric:** Beyond Chaincode: fabric SDK and Front End, Hyperledger composer tool.	**08**
IV	**Use case 1:** Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv)Insurance. **Use case 2:** Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.	**08**
V	**Use case 3:** Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems, Blockchain Cryptography, Privacy and Security on Blockchain	**08**

Text Book: 1. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”,O’Reilly 2. Melanie Swa, “Blockchain”,O’ Reilly	
Reference Book: 1. “Hyperledger Fabric”,https://www.hyperledger.org/projects/fabric 2. Bob Dill, David Smits, “Zero to Blockchain - 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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:3Cr	**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 (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. ArshdeepBahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014
3. Adrian McEwen,HakinCassimally "Designing the Internet of Things" WileyIndia

Evaluation/Assessment Methodology

	Max. Marks 100
1. Classtasks/SessionalExamination 2. Presentations /Seminar 3. Assignments	20
4. ResearchProjectReport 5. SeminarOnResearchProjectReport	10
6. ESE	70
Total:	100

Prerequisites for the course: NIL

CourseLearningOutcomes:

CO1: Able to understand the application areas of IOT

CO2: Able to realize the revolution of Internet in Mobile Devices, Cloud &SensorNetworks

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

IIMT UNIVERSITY
Year-II/Semester-IV

Programme: Degree **Class:**MCA		**Year: II** **Semester: IV**
Credits Theory:3Cr	**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 (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, ListView, Adapters, Drawables, 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 SQLite 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, LiveData, Room API, Data Binding, View Binding, MVVM Architecture Basics	**08**

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, AdMob, 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 MacLean 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 McGrawHill.

Evaluation/Assessment Methodology

	Max. Marks 100
1. Class tasks/Sessional Examination 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: II
Semester:IV</td></tr>
<tr><td>Credits
Theory:3Cr</td><td colspan="3">Subject: Distributed Database Systems</td></tr>
<tr><td>Course Code:
MCA-045</td><td colspan="3">Title: Distributed Database Systems</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>III</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>IV</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>V</td><td colspan="2">Distributed object Database Management Systems: Fundamental object concepts and models, object distributed design, architectural issues, object management, distributed object storage, object query Processing.</td><td>08</td></tr>
</table>

	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, McGraw 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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:3Cr	**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 (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 UniversityPress.

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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:3Cr	**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 (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. Classtasks/Sessional Examination 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 OpenGL.
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 Theory:3Cr	**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 (ISE+ESE)

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

Unit	Contents	No. ofLectures 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. Classtasks/Sessional Examination 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 methods 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

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA</td><td colspan="2">Year: II
Semester: IV</td></tr>
<tr><td>Credits
Theory:3Cr</td><td colspan="3">Subject: Machine Learning Techniques</td></tr>
<tr><td>Course Code:
MCA-054</td><td colspan="3">Title: Machine Learning Techniques</td></tr>
<tr><td colspan="4">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</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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;</td><td>08</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>III</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>IV</td><td colspan="2">ARTIFICIAL NEURAL NETWORKS – Perceptron's, Multilayer perceptron, Gradient descent and the Delta rule, Multilayer networks,</td><td>08</td></tr>
</table>

	Derivation of Backpropagation 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”, McGraw Hill Education

Evaluation/Assessment Methodology

	Max. Marks 100
1. Classtasks/Sessional Examination	20
2. Presentations /Seminar	
3. Assignments	
4. Research Project Report	10
5. Seminar On Research Project Report	
6. 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
CO4: learning
CO5: Analyze the concept of neural networks for learning linear and non-linear activation functions
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 Theory:3Cr	**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 aclassical 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 (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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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. Produce code and documentation that is comprehensible to a group of different programmers and present the

CO4: theoretical background and results of a project in written and verbal form.
Apply knowledge, skills, and understanding in executing a defined project of research,

CO5: 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 Theory:3Cr	**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 canbe achieved by applying the models

Nature of Paper: DSE

Minimum Passing Marks/Credits:40% Marks (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 Backpropagation 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 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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:3Cr	**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 (ISE+ESE)

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

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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, 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.	
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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) Classtasks/Sessiona Examination	20
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report	10
5) Seminar On Research Project Report	
6) 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
CO4: learning
CO5: Analyze the concept of neural networks for learning linear and non-linear activation functions Learn the concepts in Bayesian analysis from probability models and method.

Format-3

IIMT UNIVERSITY
Year-II/Semester-IV

<table>
<tr><td colspan="2">Programme:Degree
Class:MCA</td><td colspan="2">Year: II
Semester:IV</td></tr>
<tr><td>Credits
Theory:3Cr</td><td colspan="3">Subject: Quantum Computing</td></tr>
<tr><td>Course Code:
MCA-055</td><td colspan="3">Title: Quantum Computing</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="4">L:3
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th colspan="2">Contents</th><th>No. of Lectures Allotted</th></tr>
<tr><td>I</td><td colspan="2">Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.</td><td>08</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>08</td></tr>
<tr><td>III</td><td colspan="2">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</td><td>08</td></tr>
<tr><td>IV</td><td colspan="2">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,</td><td>08</td></tr>
</table>

	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**

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2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback –Import,3 Oct 2014
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Reference Book: Computer Science: An Introduction by N. David Mermin

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Evaluation/Assessment Methodology

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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.

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CO3: Trained to design QC circuits and reversible logics for real world problems.Produce code and documentation that is comprehensible to a group of different programmers and present the

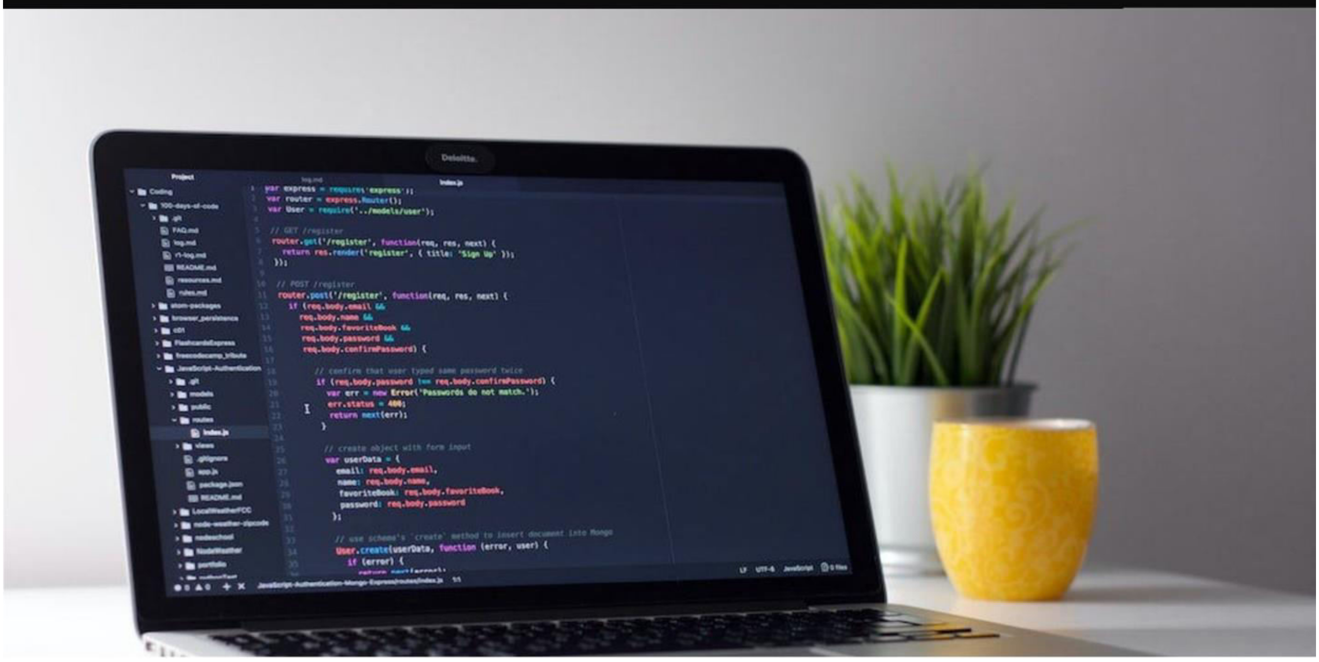
CO4: theoretical background and results of a project in written and verbal form.

Apply knowledge, skills, and understanding in executing a defined project of research,

CO5: development, or investigation and in identifying and implementing relevant outcomes.

School of Computer Science & Applications

ACADEMIC HAND BOOK



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)
(Effective from the Session: 2022-23)

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 (lectureor 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 forstudents 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 ProjectWork 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 subjectsin 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 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 areconverted 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 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)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 ofcredits of all the courses undergone by a student, i.e.

$$\text{SGPA } (S_i) = \Sigma(C_i \text{ x } G_i) / \Sigma C_i$$

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.

$$\mathbf{CGPA =} \Sigma\ (C_i \text{ x } S_{i)} / \Sigma\ C_i$$

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 SGPAIllustration No.1

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**	**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 xGrade)
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	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**	**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 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 **FIRSTDIVISION**.

(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) 1st to 6th semester for the students admitted to MCA. Program from 1st year, AndA student shall be eligible for a rank at the time of award of degree in MCA, provided the student

(b) Has passed 1st to 4th (students joining from 1st semester) 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 students 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:

- **(iii)** Two mid-term viva-voce/tests of equal weightage 30%of total Practical marks.
- **(iv)** 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 / Report50%
(b) Presentation50%

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 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 andCentrallegislationsprovidestringentpunishmentsincludingimprisonment.Oncetheinvolvemen tofastudent(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 stand in gall 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) SEMESTER-I

S.No.	Subject Code	SubjectName	CourseType	Periods			Internal	External	Total	Credit
				L	T	P				
1.	MCA-111	FundamentalofComputers&Emerging Technologies	DSE	3	1	0	30	70	100	4
2.	MCA-112	ProblemSolvingusingC	CoreTheory	3	1	0	30	70	100	4
3.	MCA-118	PythonProgramming	CoreTheory	4	0	0	30	70	100	4
4.	MCA-119	Probability&Statistics	DSE	4	0	0	30	70	100	4
5.	MCA-115	ComputerOrganization&Architecture	CoreTheory	3	1	0	30	70	100	4
6.	MCA-116P	ProblemSolvingusingC **Lab**	CorePractical	0	0	4	20	30	50	2
7.	MCA-117P	ComputerOrganization&Architecture **Lab**	CorePractical	0	0	4	20	30	50	2
8.	MCA-P1	MiniProjectlab	SkillEnhancementCourse	0	0	4	20	30	50	2
9.	ECC-111	IndustrialVisits/SeminarorPresentationBasedontheReportofVisits	SkillEnhancementCourse	0	0	0	0	0	25	0
10	ECC-112	UniversitySocialResponsibility	SkillEnhancementCourse	0	0	0	0	0	25	0
11		Sports	AuditCourse	0	0	0	50	0	50	0
		Total		17	3	12	210	440	**750**	**26**

MCA (AI&ML) SEMESTER-II

S.No.	Subject Code	SubjectName	CourseType	Periods			Internal	External	Total	Credit
				L	T	P				
1.	MCA-128	Advanced MicrosoftExcelwithTableau	**DSE**	4	0	0	30	70	100	4
2.	MCA-122	ObjectOrientedProgramming	**CoreTheory**	3	1	0	30	70	100	4
3.	MCA-129	LINUXADMINISTRATIONWITHSCRIPTING	**CoreTheory**	3	1	0	30	70	100	4
4.	MCA-124	DatabaseManagementSystems	**CoreTheory**	3	1	0	30	70	100	4
5.	MCA-125	DataStructures&AnalysisofAlgorithms	**DSE**	4	0	0	30	70	100	4
7.	MCA-126P	ObjectOrientedProgramming**Lab**	**CorePractical**	0	0	4	20	30	50	2
9.	MCA-127P	DBMSLAB	**CorePractical**	0	0	4	20	30	50	2
10.	MCA-P2	MiniProjectLab	**SkillEnhancementCourse**	0	0	4	20	30	50	2
11.	ECC-121	IndustrialVisits/SeminarorPresentationBasedontheReportofVisits	**SkillEnhancementCourse**	0	0	0	0	0	25	0
12.	ECC-122	UniversitySocialResponsibility	**SkillEnhancementCourse**	0	0	0	0	0	25	0
13.		Sports	**AuditCourse**	0	0	0	50	0	50	0
		Total		17	3	12	260	440	**750**	**26**

MCA (AI & ML) 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) 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

IIMT UNIVERSITY
Year- I / Semester –I

Program: Degree **Class:MCA(AI & ML)**		**Year**:I **Semester**: I
Credits **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.
CO 2: Design and verify various flip-flops.
CO 3: Design I/O system and ALU.
CO 4: Demonstrate combinational circuit using simulator.

Nature of Paper: Core

Minimum Passing Marks/Credits:50% Marks

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", McGraw 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:

CO 1: Students will be able to develop flip-flops.
CO 2: Students will be able to solve problems based on circuit design.
CO 3: Students will be able to learn working of ALU.
CO 4: Students will be able to Implement Binary -to -Gray, Gray-to -Binary code conversions
CO 5: 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 Theory:4Cr	**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

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 logicunit:** Look ahead carries adders. Multiplication: Signedoperand multiplication, Booth's algorithm andarray multiplier. Division and logicoperations. Floating point arithmetic operation, Arithmetic & logicunit design. IEEEStandard 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 memories: magnetic disk, magnetic tape and optical disks Virtual memory:	8

	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 Approacl 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	10
Seminar On Research Project Report	
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 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

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

Programme: Degree **Class: MCA(AI & ML)**		**Year: I** **Semester: I**
Credits Theory:4Cr	**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		
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, Element of command based and GUI based operating system. **Computer Network:** Overview, Types (LAN, WAN and MAN), Dat: communication, topologies.	8
III	**Internet:** Overview, Architecture, Functioning, Basic services like WWW, FTP, Telnet, Gopheretc., Search engines, E-mail, Web Browsers. **Internet of Things (IoT):** Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.	8
IV	**Blockchain:** Introduction, overview, features, limitations and application areas fundamentals of Block Chain. **Cryp to currencies:** Introduction, Applications and use cases **CloudComputing:**Itnatureandbenefits,AWS,Google,Microsoft&IBMServices	8

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", McGraw Hill Education.
3. GoelA.,"Computer Fundamentals",Pearson.

Reference

1. Balagurusamy E.,"Fundamentals of Computers", Mc Graw Hill
2. TharejaR., "Fundamentals of Computers", Oxford University Press.

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: 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 **Theory**:4Cr	**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

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. **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 bymethods of Moments, Defining **KURTOSIS** as Vertical distortion of Data-Platykurtic, Mesokurtic, Lep to kurtic 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. **TheoryofProbability-2:-** ConditionalprobabilityTheorem:DefiningIFTHEN,Understandingthecompound events-Independentevents,dependent(Non-Independent)Events, Multiplications Theorem of Probability, Understanding the Priori and Posterior events, Understanding the total Probability The theorem, Baye's The oremandits applications, Bernoullior 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 The oretical Distributions and its Parameters, Poisson The oretical Distributions and its Parameters, Applications of the oretical distribution to create expected frequencies. **Continuous Theoretical Distributions:-** Defining Normal (or Gaussian) Distribution-Understandingitscharacteristicsmean&variance,DefiningThestandardnormalDistribution-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-Sigmoidcurves Analysis.	10
V	**Test of significance of samples:-** Elementary theory of Testing of Hypothesis-two typesof 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,Orthogonalvectors,linearcombination,linearindependenceofvectors,Matrices-addition, Product, transpose, determinant, Identify matrix, Invertible matrix, Inverse, rank of Matrix, Trace, Spur,PopularTypesofMatrices-Symmetric, Diagonal, Orthogonal, Orthonormal, Eigen values & Eigen Vectors. **Introduction of Topology (In Brief):-** Introduction of Metric spaces (Metric distances)-Varioustypes 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 2) Presentations /Seminar 3) Assignments 4) Research Project Report 5) Seminar On Research Project Report 6) ESE	20 10 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.

IIMT UNIVERSITY
Year – I /Semester – I

Programme: Degree **Class: MCA(AI &ML)**	**Year: I** **Semester: I**
Credits **Theory**:4Cr	**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

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-els estatements, 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-dimensionaarray, Initializing arrays, Accessing array elements, Manipulating arrayelements, Arrays of unknown or varying size, Two-dimensional arrays, Multidimensiona	8

	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 topointer, Array of pointers. **Strings:**Introduction, initializing strings, accessing string elements, Arrayo f strings, Passing strings to functions, String functions.	
IV	**Structure:**Introduction, Initializing, defining and declaring structure, Accessing members, Operations on individual members, Operations onstructures,Structurewithinstructure,Arrayofstructure,Pointersto structure. **Union:** Introduction, Declaring union, Usage of unions, Operations onunion. 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. **FileHandling:** 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, GUIinteraction within the program.	8

Text Books:

1. Kanetkar Y.,"LetUsC", BPB Publications.
2. Hanly J. R. and Koffman E. B.,"Problem Solving and Program Design in C", Pearson Education.
3. SchildtH.,"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-Programmingin 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(AI &ML)	**Year: I** **Semester: I**
Credits **Theory**:4Cr	**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

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 functiontoa 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 Num Py, N-Dimensional Array Object, Array Slicing Method, Array reshaping methods, Numericalroutinesin Numpy, Introduction to Matplotlib, Python 2D plotting, Plotting with default settings, Customizing matplotlibGraphicwithcolorsandlinewidth,	10

	Generateplots, histograms, power spectra, Generate barcharts, 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.)
   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 2) Presentations/Seminar 3) Assignments 4) Research Project Report 5) Seminar On Research Project Report 6) ESE	20 10 70
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-II

Programme:Degree **Class:MCA(AI&ML)**		**Year:**I **Semester:**II
Credits Theory:4Cr	**Subject:**DATA BASE MANAGEMENT SYSTEM	
Course Code: **MCA- 124**	**Title:**DATA BASE MANAGEMENT SYSTEM	

Course Objectives:

CO 1:	Explain the concept of features of a database system and its application and compare various types of data models.
CO 2:	Describe the E-R Models and Relational Database.
CO 3:	Explain the concept of SQL Commands, relational algebra, tuple calculus and domain calculus.
CO 4:	Explain the need of normalization and normalize a given relation to the desired normal form.
CO 5:	Analyze the different approaches of transaction processing and concurrency control.

Nature of Paper: CORE

Minimum Passing Marks/Credits:40% Marks

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	8

	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	
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", 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. 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	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 Theory:4Cr	**Subject:**Data structure and analysis of algorithms
Course Code: **MCA- 125**	**Title:**Data structure and analysis of algorithms

Course Objectives:

CO 1:	Explain the concept of data structure, abstract data types, algorithms, analysis of algorithms and basic data organization schemes such as arrays and linked lists.
CO 2:	Describe the applications of stacks and queues and implement various operations on them using arrays and linked lists.
CO 3:	Describe the properties of graphs and trees and implement various operations such as searching and traversal on them.
CO 4:	Compare incremental and divide-and-conquer approaches of designingal go rithms for problems such assorting and searching.
CO 5:	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

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	8

	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.	
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,McGraw Hill
2. Samanta D,"Classic Data Structures", 2nd Edition Prentice Hall India.

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: 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

<table>
<tr><td colspan="2">Programme:Degree
Class:MCA(AI &ML)</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td colspan="2">Credits
Theory:4Cr</td><td colspan="2">Subject: LINUX ADMINISTRATION WITH SCRIPTING</td></tr>
<tr><td colspan="2">Course Code: MCA-129</td><td colspan="2">Title:LINUX ADMINISTRATION WITH SCRIPTING</td></tr>
<tr><td colspan="4">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</td></tr>
<tr><td colspan="4">Nature of Paper: Core</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits: 40% Marks</td></tr>
<tr><td colspan="4">L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">Linux History, overview, Principles, Getting started with GNOME and edit textfiles 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 vieditor, manage users and groups.</td><td>10</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>10</td></tr>
<tr><td>III</td><td colspan="2">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.</td><td>10</td></tr>
<tr><td>IV</td><td colspan="2">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)</td><td>10</td></tr>
</table>

Evaluation/Assessment Methodology	
	Max. Marks 100
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 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

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA(AI & ML)</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="3">Subject: Object oriented programming</td></tr>
<tr><td>Course Code:
MCA - 122</td><td colspan="3">Title: Object oriented programming</td></tr>
<tr><td colspan="4">Course Objectives:
CO 1: Definition of Object-Oriented Programming techniques.
CO 2: Apply Object Oriented Programming techniques using Java.
CO 3: Solve the real-world problems using of Packages, Interfaces, and apply Exceptions handling and Threading concepts in Java.
CO 4: Develop I/O and GUI applications in java.
CO 5: Design Database applications and swing programming in Java.</td></tr>
<tr><td colspan="4">Nature of Paper: CORE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:3
T:1
P:0(In Hours/Week)
Theory - 1 Hr. = 1 Credit
Practical- 2 Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>II</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>III</td><td colspan="2">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.</td><td>8</td></tr>
<tr><td>IV</td><td colspan="2">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 Programming: Generic classes, generic methods, Bounded Types: Restrictions and Limitations.</td><td>8</td></tr>
</table>

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", McGraw 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 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: 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

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA(AI &ML)</td><td colspan="2">Year: I
Semester: II</td></tr>
<tr><td colspan="2">Credits
Theory:4Cr</td><td colspan="2">Subject: Advanced Microsoft Excel with Tableau</td></tr>
<tr><td colspan="2">Course Code:
MCA-128</td><td colspan="2">Title: Advanced Microsoft Excel with Tableau</td></tr>
<tr><td colspan="4">Course Objectives:</td></tr>
<tr><td>CO1:</td><td colspan="3">Understand the need and use of excel templates.</td></tr>
<tr><td>CO2</td><td colspan="3">To provide knowledge of organizing and displaying large amounts of data.</td></tr>
<tr><td>CO3:</td><td colspan="3">Analyse data using pivot tables and pivot charts.</td></tr>
<tr><td>CO4:</td><td colspan="3">Learn the use of functions and formulas on Excel spreadsheet.</td></tr>
<tr><td>CO5:</td><td colspan="3">Learn to combine data sources using tableau.</td></tr>
<tr><td colspan="4">Nature of Paper: DSE</td></tr>
<tr><td colspan="4">Minimum Passing Marks/Credits:40% Marks</td></tr>
<tr><td colspan="4">L:4
T:0
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><td>Unit</td><td colspan="2">Contents</td><td>No. of Lectures Allotted</td></tr>
<tr><td>I</td><td colspan="2">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.</td><td>10</td></tr>
<tr><td>II</td><td colspan="2">Working with Data Ranges:-
Sorting by One Column, Sorting by Colors or Icons, Sorting by Multiple Columns, Sorting by a Custom List, Filtering Data, creatinga Custom Auto Filter, Usingan Advanced Filter.
Working with Pivot Tables:-
Creatinga Pivot Table, Specifying Pivot Table data, changinga Pivot Table’s Calculation, Filtering and Sorting a Pivot Table, Working with Pivot Table Layout, Grouping Pivot Table Items, updatinga Pivot Table, formatting a Pivot Table, creating a Pivot Table, creatinga Pivot Chart, Using Slicers, Sharing Slicers Between Pivot Tables.</td><td>10</td></tr>
<tr><td>III</td><td colspan="2">Analyzing and Organizing Data:-
Creating Scenarios, Creating a Scenario Report, Working with Data Tables,</td><td>10</td></tr>
</table>

	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 be Format. **Workingon 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 *WayneWinston*

Reference Book:
1. "Microsoft Excel Data Analysis and Business Modelling "by *Wayne Winston*

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination 2) Presentations /Seminar 3) Assignments	20
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 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	
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 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, 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 (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 2) Presentations /Seminar 3) Assignments 4) Research Project Report Seminar On Research Project Report	20
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: 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		
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 indexOutofBounds 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 2) Presentations /Seminar 3) Assignments 4) Research Project Report/Seminar on Research Project Report 5) ESE	20 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 Theory:4Cr	**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 (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	**08**

	key Infrastructure. **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", McGraw Hill.

Reference Book:

1. Kahate A., "Cryptography and Network Security", Tata McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Classtasks/Sessional Examination 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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.

IIMT UNIVERSITY
Year-II/Semester-III

Programme: Degree **Class:**MCA(AIML)		**Year: II** **Semester: III**
Credits **Theory**:4Cr	**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 (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 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/SessionalExamination	15
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report	10
5) Seminar On Research Project Report	
6) 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 Theory:4Cr	**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 (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–Costmonitoring–arned Value Analysis –Prioritizing Monitoring– Project tracking–Change control Software	**08**

	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 – DispersedandVirtualteams–Communicationsgenres–Communicationplans–Leadership.	**08**

Text Book:

1. Bob Hughes, Mike Cotterell and Rajib Mall: “Software Project Management” – Fifth Edition, McGraw 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” – McGraw Hill Education (India), Fourteenth 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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 Theory:4Cr	**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 (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 press2011.
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 McGraw-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	10
5) Seminar On Research Project Report	
6) 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 Theory:4Cr	**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 (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, translation of assignment statements, Boolean expressions, statements that alter the flow of control, postfix translation, translation with a top-down	**08**

	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 McGraw-Hill, 2003.
3. HenkAlblas 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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 Theory:4Cr	**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 (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-Iframe, 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	**08**

	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", BPBPublication

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) Classtasks/Sessional Examination 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 Theory:4Cr	**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 NoSQL 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 (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 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, **Hive** - Apache Hive architecture and installation, Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins &s ubqueries. **HBase**– Hbase concepts, clients, example, H basevs 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, BigInsights 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",McGrawHill.

Reference Book:

1. Thomas Erl, WajidKhattak, 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	10
5) Seminar On Research Project Report	
6) 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 Theory:4Cr	**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 (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	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 Theory:4Cr	**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 (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 McGraw 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/SessionalExamination	15
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report	10
5) Seminar On Research Project Report	
6) 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

CO5: Software 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(AIML)	**Year: II** **Semester: III**
Credits Theory:4Cr	**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% (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,	**08**

	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.	

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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 Theory:4Cr	**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, subnetting 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 (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 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	**08**

	Message Switching. **Logical addressing:** IPv4 and IPv6 Address schemes, Classes and subnetting **Network Layer Protocols:** ARP, RARP, BOOTP and DHCP **Routing Techniques:** Interdomain and Intradomain 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. BehrouzForouzan, "Data Communication and Networking", McGraw Hill
2. Andrew Tanenbaum "Computer Networks", PrenticeHall.
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. BehrouzForouzan, "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	10
5) Seminar On Research Project Report	
6) 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

<table>
<tr><td colspan="2">Programme: Degree
Class: MCA(AIML)</td><td>Year: II
Semester: III</td></tr>
<tr><td>Credits
Theory:4Cr</td><td colspan="2">Subject: Machine Learning</td></tr>
<tr><td>Course Code:
MCA-234</td><td colspan="2">Title: Machine Learning</td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td colspan="3">Nature of Paper: Core Course</td></tr>
<tr><td colspan="3">Minimum Passing Marks/Credits:40% Marks (ISE+ESE)</td></tr>
<tr><td colspan="3">L:3
T:1
P:0(In Hours/Week)
Theory-1Hr.=1Credit
Practical-2Hrs.=1Credit(4Hrs./Week=4Credits)</td></tr>
<tr><th>Unit</th><th>Contents</th><th>No. o fLectures Allotted</th></tr>
<tr><td>I</td><td>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 (rowise, 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.</td><td>08</td></tr>
<tr><td>II</td><td>Data handling and Visualization: Introduction to pandas. Pandas series from 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,</td><td>08</td></tr>
</table>

	mode, apply,. Matplotlib and seaborn – linear plot and scatter plot., Histogram, bar and count plots., Seaborn 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, Underfitting and Overfitting, 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 pairplot), Feature selection (for classification) with correlation, chi2 score, f classif score, mutual info classif score, K-Nearest Neighbor (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, Autoregression (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 2) Presentations /Seminar 3) Assignments	15
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 Theory:4Cr	**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 (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 stopwords, 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 (FreqDist), word stemming and Porter Stemmer, lexical database – wordnet, synsets, lemma and lemmatization, wordnet 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 regressor, artificial neural network (ANN), deep neural network (DNN), python modules for deep neural network – TensorFlow, Keras, PyTorch and Theano, deep	**08**

	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, softmax and sigmoid and activation layer, image classification using convolution neural network (CNN), overfitting and underfitting in CNN, pre-processing layers, types of models (in TensorFlow) – sequential and functional, transfer learning and model deployment.	**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.

Reference Book:

1. Stephen Marsland, —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	10
5) Seminar On Research Project Report	
6) 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 Theory:2Cr	**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, optimizethe 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 (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
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 5) Seminar On Research Project Report 6) 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 Theory:2Cr	**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 (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
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.
2. Sikar Dutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Ninth impression,.

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.

Evaluation/Assessment Methodology	
	Max. Marks 100
1) Class tasks/Sessional Examination tasks 2) Presentations /Seminar 3) Assignments 4) Research Project Report 5) Seminar On Research Project Report 6) 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.

IIMT UNIVERSITY
Year-II/Semester-IV

Programme: Degree **Class:** MCA(AIML)	**Year:** II **Semester:** IV
Credits Theory:3Cr	**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 (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, Digital Identity, Identity Management Models: From Identity 1.0 to Identity 2.0, Identity Management in Online Social Networks, Identity as Self-	08

	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 2) Presentations /Seminar 3) Assignments	20
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 Theory:3Cr	**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 (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, Fuzzymeasures. **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 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	10
5) Seminar On Research Project Report	
6) 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 Theory:3Cr	**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 (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, Fuzzyclassification.	**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	20
4) Research Project Report 5) Seminar On Research Project Report	10
6) ESE	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 Theory:3Cr	**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 (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, stockmarket predictions.	**08**
IV	**Frequent Itemsets and Clustering:** Mining frequent itemsets, market based	**08**

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	modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets 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. 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 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 Theory:4Cr	**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 (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 vectormachine.	

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 2. Presentations /Seminar 3. Assignments	15
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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

CO5: mining tool.

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 Theory:4Cr	**Subject:** Block chain Architecture	
Course Code: MCA-041	**Title:** Block chain Architecture	
Course Objectives:		
CO1:	Study and understand basic concepts of blockchain architecture.	
CO2	Analyze various requirements for consensus protocols.	
CO3:	Apply and evaluate the consensus process.	
CO4:	Understand the concepts of Hyperledger fabric.	
CO5:	Analyze and evaluate various use cases in financial software and supply chain.	
Nature of Paper: DSE		
Minimum Passing Marks/Credits:40% Marks (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 Blockchain:** Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. **Blockchain Architecture and Design:** Basic crypto primitives: Hash, Signature, Hashchain to Blockchain, Bitcoin Basic, Basic consensus mechanisms.	**08**
II	**Consensus:** Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols, distributed consensus, consensus in Bitcoin. **Permissioned Blockchains:** Design goals, Consensus protocols for Permissioned Blockchains	**08**
III	**Hyperledger Fabric:** Decomposing the consensus process, Hyperledger fabric components. **Chaincode Design and Implementation Hyperledger Fabric:** Beyond Chaincode: fabric SDK and Front End, Hyperledger composer tool.	**08**
IV	**Use case 1:** Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance. **Use case 2:** Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.	**08**
V	**Use case 3:** Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems, Blockchain Cryptography, Privacy and Security on Blockchain	**08**

Text Book: 1. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’ Reilly 2. Melanie Swa, “Blockchain”, O’ Reilly	
Reference Book: 1. “Hyperledger Fabric”,https://www.hyperledger.org/projects/fabric 2. Bob Dill, David Smits, “Zero to Blockchain - An IBM Redbooks course”, https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html	
Evaluation/Assessment Methodology	
	Max. Marks 100
1. Classtasks/Sessional Examination 2. Presentations /Seminar 3. Assignments	20
4. Research Project Report 5. Seminar On Research Project Report	10
6. 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 blockchain technologies.	

Format-3

IIMT UNIVERSITY
Year-II/Semester-IV

Programme: Degree **Class:** MCA(AIML)	**Year: II** **Semester: IV**
Credits Theory:3Cr	**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 (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, biological 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:** McCulloch-Pitts neuron model, Hebb 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 inNN.	**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 propagation algorithm performs better, applications.	**08**

	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	10
5) Seminar On Research Project Report	
6) 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 Theory:3Cr	**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 (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, ListView, Adapters, Drawables, 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, AdMob, 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., KomatineniS. And MacLeanD., "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 McGraw Hill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks 2) Presentations /Seminar 3) Assignments	20
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 Theory:3Cr	**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 (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, McGraw 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 2) Presentations /Seminar 3) Assignments	20
4) Research Project Report 5) Seminar On Research Project Report	10
6) 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 a knowledge of the fragmentation in distributed database systems.
CO4: Understand of query processing, data and access control of distributeddatabase 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 Theory:3Cr	**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 (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 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", McGraw Hill.
2. Sinha A. N. and Udai A. D.," Computer Graphics", McGrawHill.

Evaluation/Assessment Methodology

	Max. Marks 100
1) Class tasks/Sessional Examination tasks	20
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report	10
5) Seminar On Research Project Report	
6) 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 OpenGL.
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(AIML)	**Year: II** **Semester: IV**
Credits Theory:3Cr	**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 (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. AksharBharti, VineetChaitanya and Rajeev Sangal, "NLP: A Paninian Perspective", Prentice Hall, New Delhi.
2. James Allen, "Natural Language Understanding", PearsonEducation.
3. D. Jurafsky, J. H. Martin, "Speech and Language Processing", PearsonEducation.

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	10
5) Seminar On Research Project Report	
6) 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 modelling 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 Theory:3Cr	**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 (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 Backpropagation 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	10
5) Seminar On Research Project Report	
6) 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 Theory:3Cr	**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 (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) Classtasks/Sessional Examination	20
2) Presentations /Seminar	
3) Assignments	
4) Research Project Report	10
5) Seminar On Research Project Report	
6) 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. Produce code and documentation that is comprehensible to a group of different programmers and present the

CO4: theoretical background and results of a project in written and verbal form.
Apply knowledge, skills, and understanding in executing a defined project of research,

CO5: 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 Theory:3Cr	**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 (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, communicating data with H/W units, mobiles, tablets, Designing of smart	08

	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. ArshdeepBahga, 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 2) Presentations /Seminar 3) Assignments	20
4) Research Project Report 5) Seminar On Research Project Report	10
6) ESE	70
Total:	100

Prerequisites for the course: NIL

Course Learning Outcomes:

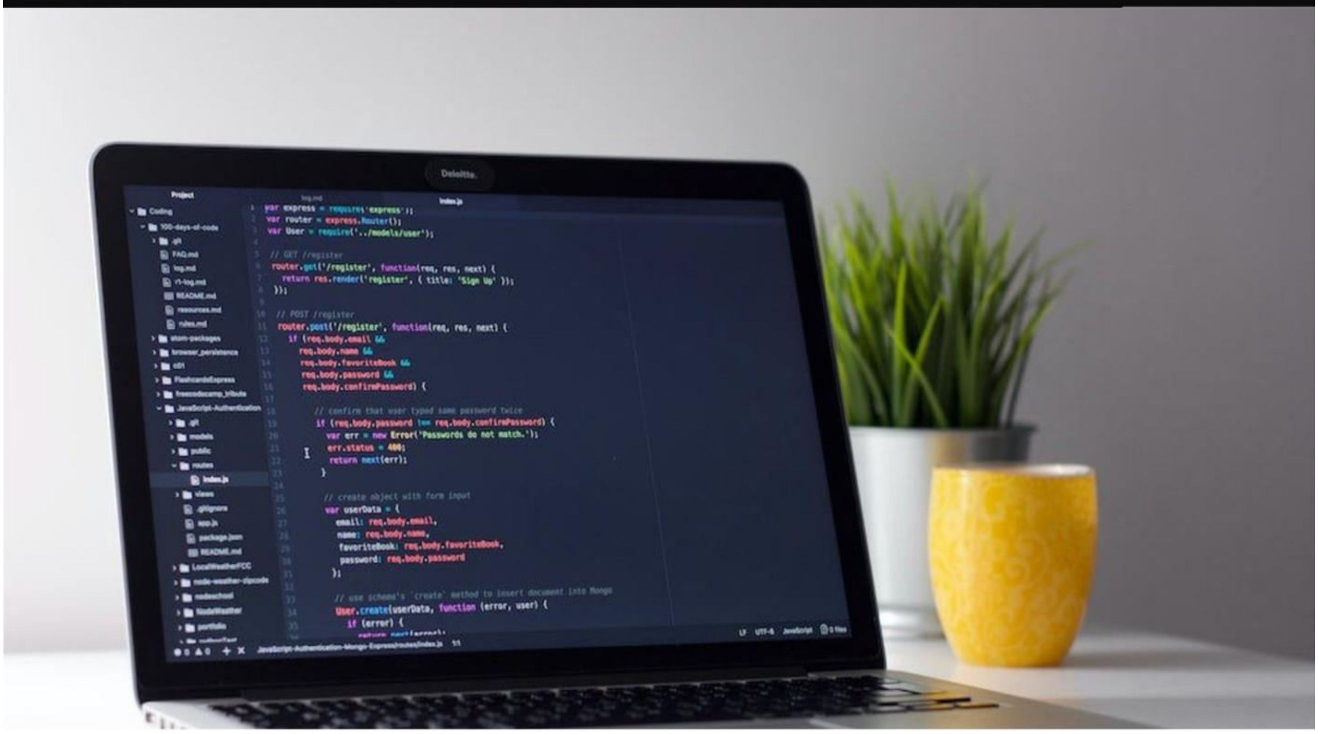
CO1: Able to understand the application areas of IOT
CO2: Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
CO3: Able to understand building blocks of Internet of Things and characteristics.
CO4: Apply IoT for developing real life applications using Arduino programming.
CO5: To develop IoT infrastructure for popular applications

IIMT UNIVERSITY
MEERUT (U.P.)
Transforming Education System, Transforming Lives

UGC Approved
Section 2f & 12B

School of Computer Science & Applications

ACADEMIC HAND BOOK



Ph.D. Program (Computer Science and Applications)

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

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 ofresearch.*

Course Detail	PAPER-I: AdvancedResearch 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 Textbooks:

1. "Research Methodology-Methods and Techniques", by C.K. Kothari (2004), NewAge 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 andGeorge 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	DetailSyllabus

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 andinternational 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 Univ 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 Doestoevsky'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/NoSQL 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, Blockchain, Apache Spark, Google's Chubby, Apache Zookeeper, HBase, MapReduce, Apache Cassandra, Google's B4, Microsoft's Swan

Recommended Textbooks:

1. "Elementary Number Theory" by David M. Burton, Tata McGraw Hill Publication
2. "A Course in number theory and cryptography" by Neal Koblilz, Springer-Verlag Publication
3. "Cryptography & Network Security" by Behrouz Forouzan, Tata McGraw-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 ChristofPaar& Jan Pelzl, Springer Heidelberg Dordrecht, London New York, 2010
7. "Blockchain 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 Cybersecurity (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, JohnWillley 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' AddisonWesleyPublishing 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" bySimon 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

UNITI

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.

UNITII

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).

UNITIII

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,

UNITIV

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"McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], 2009.
3. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 1 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

UNITI

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.

UNITII

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.

UNITIII

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.

UNITIV

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 Goodfellow, 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, Backpropagation, 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-Interscience, 2000.
4. Mitchell T, “Machine Learning”, McGraw-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 daCosta, 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 TradeCommission, 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 Communications. E 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.