

SCHOOL OF AGRICULTURE SCIENCE

ACADEMIC HAND BOOK



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**NEW SYLLABUS AND EVALUATION SCHEME
UNDER GRADUATE CURRICULA & SYLLABUS
B.Sc. (Hons.) Agriculture
(Academic Session 2025--26)**

Restructuring of Undergraduate Programmes

The restructuring has been done based on the following -

Year-1, Certificate Course.

Year-2, Diploma Course.

Year-4, B.Sc. (Hons.) Agriculture

The restructured program for the undergraduate agriculture education with multiple entry and exit options is illustrated in Figure 1.1.

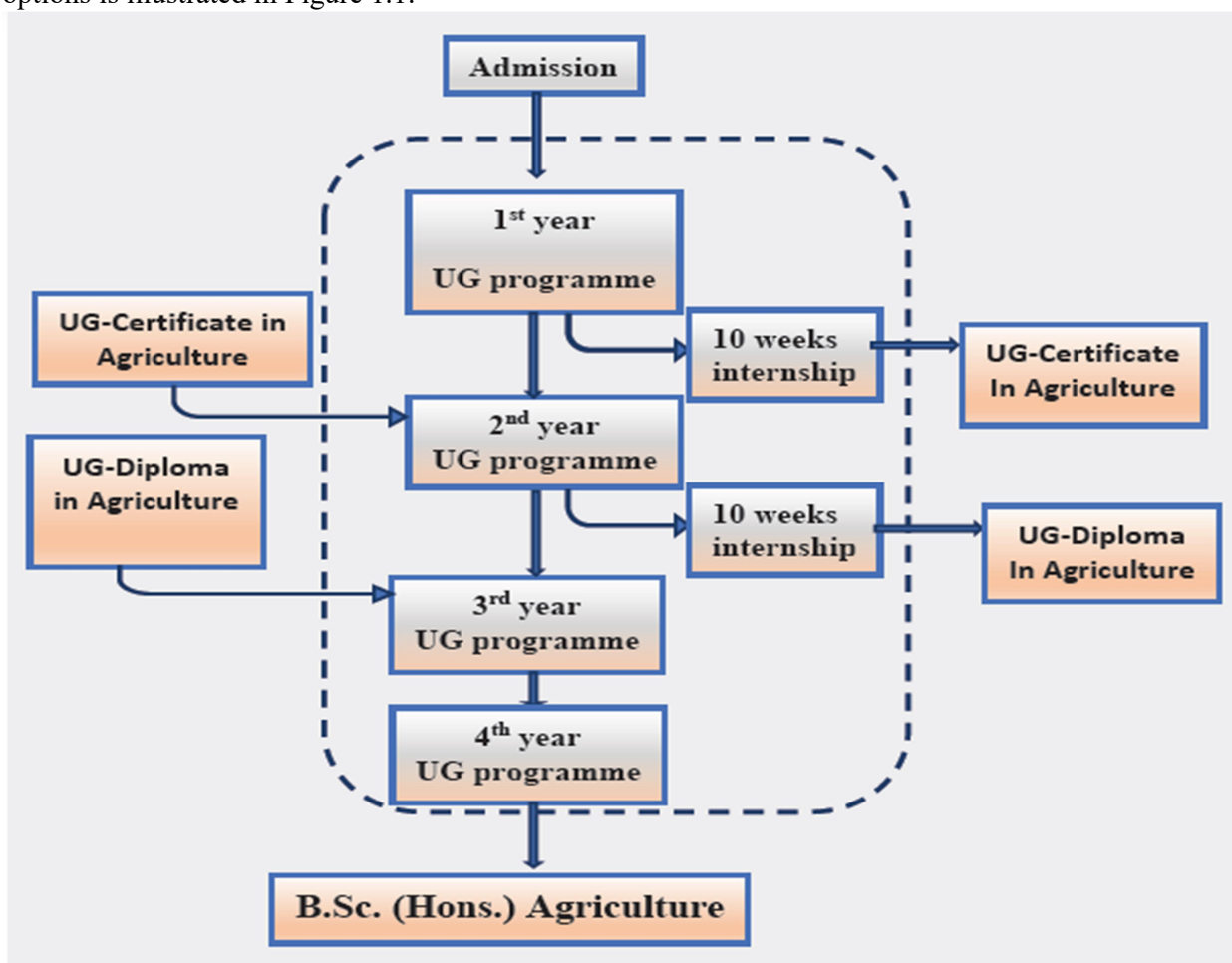


Fig. 1 Entry and Exit options for the UG programme in Agriculture

The eligibility for entry into the UG programs will be + 2 Science & Agriculture; the students will be admitted as per norms of ICAR/ SAUs/CAUs. The 1st year of the programme will be having the foundation, introductory and skill enhancement courses. The 2nd year will be having basic core courses with some more options for skill enhancement. The 3rd year of the programme will have advanced core courses. The 4th year programme will emphasize more on the specialization and elective courses as well as advanced skill enhancement through internship.

There will be exit options after 1st year and 2nd year for UG-Certificate and UG-Diploma. However, the students opting to exit with UG-Certificate or UG-Diploma will have to take up 10 weeks internship after the 1st year (2 semester) and 2nd year (4 semesters), respectively. Table 1.1 shows the restructured undergraduate programs for the higher agricultural educational institutions (HAEIs).

Table 1.1 Types of courses and learning outcomes for the restructured under graduate programs for the HAEIs

Year	Types of courses	Learning outcome	Exit option
Year-1	Foundation courses, introductory courses and skills enhancement training/ training in the chosen area, ability enhancement courses	Students will acquire the basic knowledge in respective disciplines and adequate skill in some selected areas, to enable them for employment/ entrepreneurship	A student must complete 10 weeks of internship (10 credits) after 1st year if exit with UG-Certificate is opted
Year-2	Basic core courses and additional skill enhancement in chosen areas/ courses	Students will acquire the higher level knowledge in respective disciplines and adequate skill in some selected areas, to enable them for employment at middle level / supervisory level or for entrepreneurship	A student must complete 10 weeks of internship (10 credits) after 2nd year if exit with UG-Diploma is opted
Year-3	Advanced core subjects and their practical applications	Students will have deeper understanding of the subjects and their major application areas	No exit after 3rd year
Year-4	Specialization/ Elective courses and advanced skill enhancement through project and internship	Students will acquire advanced knowledge and skill in different areas so as to meet the higher order requirements of the society and industry as well as other prospective employers. It will also enable the graduates to become a job provider rather than being a job seeker through establishment of enterprises in concerned fields.	UG degree in concerned discipline

Credit Hours Allocation

A total of 166-174 credit hours is recommended for the four years of UG programs. The credit distributions for the different courses have been specified for individual disciplines. The general structure is given in Table 1.2.

Semester	Core Courses (Major+ Minor)	Multi-Disciplinary Course (MDC)	Value Added Course (VAC)	Ability Enhancement Course (AEC)	Skill Enhancement Course (SEC)	Internship/ Project/ Student READY	Total Credits	Non-Gradual	Online Courses/ MOOC
I	12	3(2)		1(3) + 2(4)	4	-	22	2(1)	

II	10	3(5)	3(6)	1(3) + 2(7)	4	-	23	-	10
Post-II semester						10(12)			
III	16	----		2(8)	2	-	20		
IV	12	3(9)	3 (10)	----	2	-	20	-	
Post-IV semester						10(13)			
V	21	-	-	-	-	-	21	2(11)	
VI	21	-	-	-	-	-	21	-	
VII	20	-	-	-	-	-	20	-	
VIII	-	-	-	-	-	20	20	-	
Total	112	9	6	8	12	20	167	4	

Table 1.2 General Credits Allocation Scheme of UG Programs (Credit hours)

- 1) Deeksharambh (Induction-cum-Foundation Course) of 2 credits (2 weeks duration).
- 2) Farming based Livelihood systems
- 3) NCC/NSS;
- 4) Communication Skills;
- 5) Entrepreneurship Development and Business Management
- 6) Environmental Studies and Disaster Management;
- 7) Personality Development;
- 8) Physical Education, First Aid, Yoga Practices and Meditation.
- 9) Agriculture Marketing and Trade;
- 10) Agriculture Informatics and Artificial Intelligence
- 11) Study tour (10-14 days).
- 12) Only for those opting for an exit with UG-Certificate.
- 13) Only for those opting for an exit with UG-Diploma

One multidisciplinary course in Agricultural Engineering discipline is different from the above common courses keeping in view the discipline specific requirement.

Note:-

- The credit hours mentioned in the Table 1.2 include both theory and practical.
- The total credit allocation and the allocation for different types of courses including online courses for some disciplines such as Agricultural Engineering, Dairy Technology and Food Technology are slightly different than those mentioned in the Table 1.2, so as to accommodate the specific need of these disciplines.
- Also, some minor deviations in the courses and credits allocations are allowed across disciplines considering the specific nature of the courses.
- The three-year course curricula of all disciplines of agricultural and allied sciences do not cover the teaching of elective/ specialized courses, that in fact qualify the students in specializing in a particular subject in which the student intends to do further studies. These courses have been presently listed under the 7th and 8th semesters (in IV year). Therefore, the Sixth Deans' Committee is of the view that the option of B. Sc. (Hons.) Agriculture with research may lead to deficiency of the knowledge and learning of the elective / specialized subjects needed for PG studies.

- For B. Tech. programs, the framework prescribed by AICTE/ UGC may be applicable. Under such circumstances, the Committee recommends that the launching of UG degree with research should be deferred for the time being. ICAR may consider about this aspect along with considering restructuring PG/ Ph.D. programs. Also considering the professional nature of the courses, the exit after at the end of 3rd year (at the end of 6th semester) is not recommended.
- Each class (contact hour) will be of 50 min duration and one practical will be of two contact hours.

Deeksharambh (Introduction- cum-foundation course)

The goal of higher education is to nurture students by blossoming their hidden potentials to pursue the academic and professional studies in a diligent, honest and responsible manner. It is possible by facilitating them to develop a sense of integrity with diverse faculties and build linkages with peers, society and community as a whole and lastly be proficient in earning livelihood independently along with sustaining society and nature.

A course entitled Deeksharambh (0+2) (Non-gradual) will be offered at the start of first semester for a duration of two weeks. This will be a part of first semester for all purposes including the calculation of Net Instruction Days (NIDs).

The goal of Deeksharambh is to inculcate life skills, develop bonding with mentors, peers and seniors, familiarize with institutional academic framework and functioning, It must educate students to explore their potentials and understand the purpose of their life with reference to serving the community, nation and global society.

Often the incoming undergraduate students are influenced by their parents and relatives to join higher studies, without understanding their own interests and talents. Therefore, the very purpose of initiating Deeksharambh: the induction cum foundation course is to acclimatize the student with the new surroundings, develop bond with fellow students and teachers. It is the time when a student should become clear as to what he/she is going to study in a particular discipline, or even it is time to quit and join another discipline of his/ her choice. They must develop sensitivity towards various issues of social relevance and imbibe human values to become responsible citizens.

Thus, ensuring a well-designed Induction-cum-foundation program by the institutions shall be designed to become helpful to both teachers and students for setting the pace of productive teaching and learning experiences.

Four Pillars of Deeksharambh

Socializing: Meeting new students, senior students, attend lectures by Eminent People.

Associating: Visits to university / college, visits to Dept./Branch/ Program of study and important places on campus, local area, city and so on.

Acclimatizing with rules and regulations, student support system, etc.

Experiencing: Subject lectures, study skills, small-group activities, physical activity, creative and performing arts, literary activities, universal human values, etc.

Deeksharambh will create a platform for students to:

- learn from each other's life experiences,
- help for cultural integration of students from different backgrounds,
- know about the operational framework of academic process in university,
- instilling life and social skills,
- social awareness, ethics and values, team work, leadership, creativity, etc., and
- Identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.

There will be sessions by alumni, business leaders, outstanding achievers in related fields, people with inspiring life experiences as well as the University academic and research managers.

Steps will be taken by the institutions to identify the strength and weakness of students (with remedial measures) and diverse potentialities and to enhance cultural Integration of students from different backgrounds.

Common Courses

The following common courses have been proposed to be offered across the disciplines, which in addition to giving the students a broader view of agriculture and allied sectors, will enable them for better communication skills and personality development. Besides, this will also help them to-- look beyond the boundaries of their own subject/ discipline, and collaborate in future with other sectors to face the next generation challenges from a holistic point of view.

- Farming based livelihood systems
- Entrepreneurship Development and Business Management
- Agriculture Marketing and Trade
- Communication Skills
- Personality Development
- Environmental Studies and Disaster Management
- Agricultural Informatics and artificial Intelligence

In addition to these common courses and Deeksharambh, the courses as Physical Education, First Aid, Yoga Practices and Meditation, NCC and NSS have also been made compulsory for students for improving social awareness, ethics, moral values and health of the future generation.

Deficiency courses

If the student has to take up any deficiency course(s), it has to be completed within the first year.

Entrepreneurship development

Entrepreneurship is a key driver of the economy of a nation, which has been encouraged through NEP-2020. Expectation is that an early orientation of the young minds towards skill enhancement and entrepreneurship will inculcate entrepreneurial mind set, allowing them to have first-hand experience of working with institutions, organizations, companies, industrial setup and investors so as to understand their dynamics in the real-world setting.

The restructured undergraduate curricula are designed to enable the students to take up entrepreneurship as a career path. As per NEP-2020, the curricula in all the disciplines of Agricultural

education have been refined and fine-tuned with intensive focus on choice-based skill enhancement programs.

- Skill enhancement courses are included in following different modes:
- skill enhancement courses in the 1st year and 2nd year as part of the course programs;
- internship for exit programs after 1st year/ 2nd year; and
- Advanced skill enhancement through Student READY: Experiential Learning/Hands on Training/Skill development/ RAWE/ Industrial attachment/IPT/ student project and Internship etc. in 4th year.

Internship can be seen as a mini capsule of intense learning for a student, a way to apply the theory into practice, expand their knowledge base and a platform to integrate all learnings of formal classroom setup.

Addition of new age courses related to Agriculture, Forestry, Fisheries, Agricultural Engineering, Community Science, Food Nutrition and Dietetics, etc., and incorporation of choice based online courses, which can be taken up from NPTEL, moo KIT, edX, Coursera, SWAYAM or any other portal in open digital learning environment. Practical exercises and teaching methodology are so designed to make the young generation more imaginative, innovative, ingenious, creative and competent.

The skill set acquired must make them proactive, pioneering, prospect oriented during their internship or industrial attachment to serve as apprentices in the relevant field. This will empower them to grasp viable avenues of self-employment and entrepreneurship along with diversified career options in different facets of related domains.

Skill Enhancement Courses

The skill enhancement programs will be choice based; student can choose the areas of skill enhancement from a bouquet of skill enhancement modules offered by the parent institution. The institutions will develop capabilities for offering such courses.

An institution is at liberty to (and in fact, it should) work in partnership with capable organizations/ companies/NGOs/progressive entrepreneurs/ farmers for running various skill enhancement programs.

In the report, for each discipline the list of Skill Enhancement Courses (SEC) has been suggested. The University/ HAEIs may also formulate and offer courses in any other areas as identified by it, based on institutional expertise/ capabilities/ resources. In addition, the skill enhancement courses suggested by the UGC, as listed, may also be offered.

The evaluation of the skill enhancement programs will be as per the evaluation criteria of courses with only practical. However, for the internship programs, the evaluation will be done jointly by the host and parent organisations/institutions.

Internship

The internship proposed under NEP-2020 have been an integral part of agricultural education (as proposed by Fifth Deans' Committee) under the broad category of Student READY programs. It includes various activities such as Experiential Learning/ Hands-on Training, Skill Development

Training, Rural Agriculture Work Experience (RAWE), In-Plant Training/ Industrial Attachment and Students' Projects. Therefore, in the recommended structure, the student READY is further strengthened as per NEP-2020 guidelines.

Those students who wish to exit with UG-certificate after one year, has to undergo 10 weeks of internship programme (10 credits) after 1st Year. Similarly, the students who wish to exit with UG-Diploma after second year, has to undergo 10 weeks of internship programme (10 credits) after 2nd Year. The goal of Internship at exit for UG-Certificate and UG-Diploma is to further strengthen skills in the chosen area/ subject.

Internship should be preferably arranged outside of the parent institution at any assigned organization/ industry/ research institution/ project or with a progressive farmer/ agri enterprise, etc.

HAEIs will ensure that the Internship program is aligned with the course that the student has chosen. It is recommended that each HAEI appoints one or more Coordinators for the internship programs. The coordinator must plan/execute/ monitor internship programme implementation at the institution level.

Projects

For some disciplines, projects have been kept as an integral part of the course programme. This will enable the students to develop required competencies and skill in either research or entrepreneurship or potential employment avenues rather than having only mere qualifications, choose appropriate career in research or employment/ entrepreneurship, discover their interests, aptitudes and potentialities and maximise his/ her potentialities and self-confidence. It will also add to creativity and critical thinking of the students. This will also help the students gain research skills and be more innovative in planning, executing, reporting and presenting the things.

Study tour

There will be a study tour of 10-14 days' duration during the 6th semester of the UG programme. The students will preferably visit the leading industries/ enterprises/ institutions/ organisations and other places of academic interest outside the state (of location of the institution). This, in addition to exposing the students to the indigenous as well as the latest technologies in their related fields, will also help the students to know about the socio-economic-cultural variations within the country. The course will be of 0+2 credits, non-gradual.

Online courses

The students will have to take a minimum of 10 credits of online courses, which will comprise of one or more courses, as a partial requirement for the UG programme.

(As per UGC guideline, a 1- to 3- credit SWAYAM course is expected to be covered in 4-12 weeks' duration including the assessment component, in which it should be 40 hours for 3- credit courses to 80 hours for a 6-credit course for the learning from e-content, reading references material, discussion forum posting and assignment.)

The online courses can be from any field such as Basic Sciences, Humanities, Psychology, Anthropology, Economics, Engineering, Business Management, Languages including foreign language, Communication skills/ Music, etc., and can be taken from NPTEL, mooKIT, edX, Coursera, SWAYAM or any other portal.

The objective is to allow the students to groom their passion or strengthen their knowledge and competency in any field beyond prescribed courses.

The courses will be non-gradual as separate certificates would be issued by institutes offering the courses. *These can be taken any time during the duration of UG program, but preferably during the 3rd and 4th years.*

The University/ institute will keep a record of such courses registered and completed by each student and will indicate the title of the (successfully completed) courses in final transcript issued to the student.

The requirement of credits for online courses for other programs is different due to the specific need of the disciplines.

Elective courses

The institutions will offer a bouquet of Elective courses to be offered to the students. The students will have the freedom to choose a subject among these courses. The institutions should develop capabilities to offer maximum of the Elective courses proposed in this report. The institutions will also have the liberty to develop and offer more Elective courses relevant to the subject as per local/ regional needs and available expertise. The elective courses can be offered from other disciplines in a University /HAEI.

Imparting Traditional Knowledge, Values and Ethics

Due emphasis has been given for imbibing the traditional knowledge, values and ethics among the students through different courses like the Deeksharambh, NCC and NSS. It is proposed the study tour shall be conducted across the country to be aware about the socio-cultural-economic status of the people of the country and develop respect for their values and ethics

Light but tight educational programme

As per the norms of the NEP-2020, the programme has been made light but tight for the students. The total credit hours vary from 166-174 considering the specific need of the professional courses. At the same time, the students have been given the option of the skill development courses, internship, online courses, etc., which will make their learning experience pleasurable and learning more efficient.

Moderation of courses at institution level

The following flexibility is allowed to the institutions for offering the courses:

- A. **Maximum 30% modification in the syllabus for any individual subject.** It is recommended the HAEI should consider updating the course curricula **around 5% every year**. That would enable addition of new contents replacing obsolete/ old contents in the courses.
- B. Formulation /addition/ change of Skill Enhancement modules as per needs/ facilities available.
- C. Interchange of courses in between semesters within a year (but no change of course shall be normally allowed in between years).
- D. Change of maximum two core courses (If any course is removed from the list of core course, it should be kept as elective), However, the total credit hours should not be lower than the prescribed.
- E. Inclusion of any number of courses as Electives and freedom to offer the Elective courses.

- F. Modification/ change of credit hours for any four courses (however, total credit hours should not differ by more than four).
- G. In case the skill enhancement/ internship programs are conducted in collaboration with industry/ other organizations/ agencies, students may be expected to remain out of the campus for a certain period within the semester. In that situation, the timetable should be so adjusted for the remaining part of the net instruction days (NIDs) of the corresponding semester, which each credit has at least 15 contact hours.

Central Assistance for strengthening higher agricultural education

The central Assistance for strengthening higher agricultural education, as proposed by the Fifth Deans' Committee, may be continued.

Admission Criteria

The eligibility and mode of admission for entry into the UG programs will be as per the prevailing ICAR/ SAU norms.

Agricultural universities/colleges and other general universities offering agricultural disciplines, will fall under the umbrella of ICAR, as PSSB for agricultural education, as mandated by NEP-2020.

Institutions are at liberty to assess their student intake capacity, and announce the number of seats available in the first semester, and for lateral entries at 3rd semester and 5th semester.

The lateral entry at 3rd semester will be for the candidates having UG-certificate or those who have completed Diploma (3 years course after 10th) in recognised institutions. The lateral entry in 5th semester will be for candidates who have completed UG-Diploma.

There cannot be guarantee for migration to another HAEI. Institutions are at liberty to make their own decisions/ norms/guidelines on the matter of seats and admissions in 3rd and 5th semesters.

Migration from one University to other

The UG-Certificate/ UG-Diploma passed candidate from a HAEI will be eligible for admission into any agricultural university/institution in the country at appropriate level, provided the admitting university has provision of seats to admit them.

It is recommended to make institutional **migration after 4th semester** more convenient. HAEIs are at liberty to put in place rules/ regulations relaxing/ modifying existing provisions of migration, providing more freedom and ease to students. The migration shall be subject to availability of seats at the accepting HAEI.

Provided further, any such rule/ regulation that is notified by UGC regarding changes in admission criteria, migration, etc., these notifications will be considered/ examined by ICAR and re-notified to make them applicable to agricultural education falling under its domain.

Exit Option

There will be three exits during the restructured UG programme.

Exit after 1st year:

A student may opt to exit after the 1st year of UG programme. However, he/ she has to complete 10 weeks of internship (10 credits) to be eligible for being awarded UG- Certificate degree. (The students going to the higher level need not take 10 weeks internship at this stage.)

Exit after 2nd year:

A student may opt to exit after the 2nd year of UG programme. However, he/she has to complete 10 weeks of internship (10 credits) to be eligible for being awarded UG Diploma. (The students going to the higher level need not take 10 weeks internship at this stage.)

Exit after 4-years programme leading to B.Sc. (Hons.) Agriculture degree.

Maximum residential period

Students who exit with a UG- Certificate or UG- Diploma are permitted to re-enter within three academic years and complete the degree programme.

Students may be permitted to take a break from the study during the period of study but the total duration for completing the programme *shall not exceed 7 years*.

Examination and Evaluation system

There will be a uniform system of the evaluation and grading to be followed with Grade point average (GPA) system. The following pattern of examination is recommended.

Table 1.3 Evaluation system

	External theory	Internal theory (Mid-term)	Quiz/ progressive assessment	Final Practical
For courses having both theory and practical components	40%	20%	20%	20%
For courses with theory only	50%	30%	20%	-
Courses with practical only	-	30%	20%	50% (Internal)

For the external theory examinations, the question paper will be obtained from external experts. The HODs of the respective departments will ensure due coverage of the syllabus with the provision of moderation, if necessary. Paper evaluation to be done by a faculty other than the course instructor (s).

The external theory examinations should be of 2 to 2.5 hours' duration and the mid-term examinations should be normally of 1-hour duration. The format of assessment and duration of quizzes/ progressive assessment duration will depend upon the course teacher. Internal practical examination to be conducted by the course instructor and one faculty nominated by the HOD of the concerned department.

The evaluation of the skill enhancement courses will be done as courses with practical only. Usually for any subject, there will be two quizzes within the semester, one before the mid-term and one after. There will be provision of corrections in between, i.e. the students scoring lower than 50% marks in

any one quiz can opt for appearing for a third quiz to improve their grades. The assessment of the students through quizzes should focus on their critical thinking and creativity rather than rote reading.

The quiz and progressive assessment can also be considered in form of group assignments (which should encourage creativity, critical thinking and problem-solving attitude).

The evaluation of internship will be done both by the parent institute and the host industry/organization. It should be 50% weightage for each. The student shall submit a report to the parent institute and present the learnings before the other students and faculty after the internship programme. The format of evaluation may be developed by the parent institute.

The online/MOOC courses, successfully completed by the student, will be indicated in the transcript with ‘**Satisfactory**’ remark.

When students take deficiency course(s), they will be assessed as ‘**Satisfactory**’ or ‘Un- satisfactory’ without any grade points.

The evaluation will be done on a 10-point scale.
10 point = 100 marks

The per cent of marks in a subject will be divided by 10 to obtain the grade point. The grade point average for a semester will be calculated as follows.

$$\text{GPA} = \frac{\sum(\text{Grade point} \times \text{credit hours}) \text{ in one semester}}{\text{Total credit hours in the semester}}$$

The Cumulative grade point earned at any stage of the course will be calculated as cumulative grade point average (CGPA) as follows.

$$\text{CGPA} = \frac{\sum(\text{Grade Point} \times \text{Credit hours}) \text{ until last semester}}{\text{Total credit hours until last semester}}$$

Total credit hours until last semester If a student passes in a subject in a second attempt, for calculation of CGPA, the grade point for the subject in the second attempt will only be considered. The final CGPA will be named as overall grade point average (OGPA), which will be mentioned in the final transcript of the students.

Award of Divisions

The award of the divisions will be as follows

Table 4.4 Award of the divisions

OGPA	Division
5 to <6	Pass
6 to <7	II division
7 to <8	I Division
>=8	1st division and distinction

Uniformity in Nomenclature of Degrees

To ensure hassle free movement of students throughout the country, it is important that nomenclature of degrees awarded is same, across all HAEIs. The nomenclature will be as follows.

A. UG-Certificate with mention of discipline

Note:-1. If any institution is at present offering any certificate course of the duration of one year lower, it may continue to do so, but this certificate course will not be considered at par with the UG-Certificate, if the student has not taken admission through the appropriate entrance examination for entry into the 4-year UG program. UG-Diploma with mention of disciplines e.g. UG-Diploma in Agriculture.

2. If any institution is at present offering any Diploma course of two years or less than two years' duration after+2 Science/Agriculture. It may continue to do so, but this diploma course will not be considered at par with the UG-Diploma, if the student has not taken admission through the appropriate entrance examination for entry into the 4-year UG program.

Academic Bank of Credits (ABC)

As per NEP-2020 guidelines, the HAEI will create an Academic Bank of Credits (ABC) of each student and recognize the ABC of a student as per the norms of the HAEI/ NEP-2020 recommendations.

Blended learning: Blended learning has gained tremendous popularity as it combines the benefits of traditional classroom teaching with emerging technology and online educational resources to make learning more real-time, contextual and engaging. This provision will enable blended learning to expand the open /distance learning options and to promote extensive use of technology in learning and skilling. This would help in overcoming the constraints of physical infrastructure and scalability while enhancing access, equity, and affordability and ensuring quality and accountability. The blended learning option shall also enhance accessibility of learning for Divyangs.

Eligibility for entry into 1st year UG programme: 10+2 Science with Biology or Maths or Agriculture stream.

Nomenclature:

- **UG-Certificate in Agriculture** if the student quits after completion of First year courses and 10- week internship.
- **UG-Diploma in agriculture** if the student quits after completion of second year courses and 10 –weeks internship
- **B.Sc. (Hons) Agriculture** upon completion of four year programme.



Evaluation Scheme

Year: I / Semester: I

S. No	Course Code	Course Name	Credit Hours			Evaluation Scheme				
			L	P	Total Credit	Ext. Theory + Internal Assignment			Final Practical	Total Marks
						EA	IA	PA		
Core Course										
1	AGR-111	Rural Sociology and Educational Psychology	2	0	2	50	30	20	-	100
2	AGR-112	Fundamentals of Agronomy	2	1	3	40	20	20	20	100
3	AGR-113	Fundamentals of Soil Science	2	1	3	40	20	20	20	100
4	AGR-114	Fundamentals of Horticulture	2	1	3	40	20	20	20	100
Common Course										
5	AGR-115	Communication Skills	1	1	2	40	20	20	20	100
6	AGR-116	Farming Based Livelihood Systems	2	1	3	40	20	20	20	100
Skill Enhancement Courses										
7	SEC-114	Animal Feed Management under Natural Farming	0	2	2	-	30	20	50	100
8	SEC-126	Organic Production Technology	0	2	2	-	30	20	50	100
Ability Enhancement Courses										
9	SPWC-111	SPORTS	0	1	1	-	-	-	25	25
NC**: Non- Gradial Course										
10	UGF-111	Deeksharambh (Induction Cum Foundation Course)	0	2	2	-	-	-	100	100
11	AGR-117	Introductory mathematics	1	0	1	50	30	20	-	100
	AGR-118	Introductory Biology	1	0	1	50	30	20	-	100
Total			11	10	21	900				
Note: 1. Agriculture & Bio based students will study: Introductory mathematics 2. Math based students will study: Introductory Biology										

- **Online Courses/ MOOCs** (The online/MOOC courses, successfully completed by the student, will be indicated in the transcript with ‘Satisfactory’ remark.)
- **National Service Scheme (NSS-I)/ National Cadet Corps (NCC-I) - optional course**

Year: I / Semester: II

S. No	Course Code	Course Name	Credit Hours			Evaluation Scheme				
			L	P	Total Credit	Ext. Theory + Internal Assignment			Final Practical	Total Marks
						EA	IA	PA		
Core Course										
1	AGR-121	Soil Fertility Management	2	1	3	40	20	20	20	100
2	AGR-122	Fundamentals of Entomology	2	1	3	40	20	20	20	100
3	AGR-123	Livestock and Poultry Management	1	1	2	40	20	20	20	100
4	AGR-124	Fundamentals of Plant Pathology	2	1	3	40	20	20	20	100
Common Course										
5	AGR-125	Personality Development	1	1	2	40	20	20	20	100
6	AGR-126	Environmental Studies and Disaster Management	2	1	3	40	20	20	20	100
Skill Enhancement Courses										
7	SEC-117	Post-harvest Processing Technology	0	2	2	-	30	20	50	100
8	SEC-129	Artificial Intelligence in Agriculture	0	2	2	-	30	20	50	100
Ability Enhancement Courses										
9	SPNC-121	SPORTS	0	0	0	-	-	-	25	25
Total			10	10	20	825				
AIS-121		Internship of 10-weeks duration	10 (0+10) Only for Exit opting students							

- **Online Courses/ MOOCs** (The online/MOOC courses, successfully completed by the student, will be indicated in the transcript with ‘Satisfactory’ remark.)
- **National Service Scheme (NSS-II)/ National Cadet Corps (NCC-II) - optional course**

Year: II / Semester: III

S. No	Course Code	Course Name	Credit Hours			Evaluation Scheme				
			L	P	Total Credit	Ext. Theory + Internal Assignment			Final Practical	Total Marks
						EA	IA	PA		
Core Course										
1	AGR-211	Principles of Genetics	2	1	3	40	20	20	20	100
2	AGR-212	Crop Production Technology-I (<i>Kharif crops</i>)	1	2	3	40	20	20	20	100
3	AGR-213	Production Technology of Fruit and Plantation Crops	1	1	2	40	20	20	20	100
4	AGR-214	Fundamentals of Extension Education	1	1	2	40	20	20	20	100
5	AGR-215	Fundamentals of Nematology	1	1	2	40	20	20	20	100
6	AGR-216	Principles and Practices of Natural Farming	1	1	2	40	20	20	20	100
7	AGR-217	Livestock Breeding and Nutrition	2	1	3	40	20	20	20	100
Common Course										
8	AGR-218	Entrepreneurship Development and Business Management	2	1	3	40	20	20	20	100
9	AGR-219	Physical Education , First Aid ,Yoga Practices and Meditation	0	2	2	-	30	20	50	100
Skill Enhancement Courses										
10	SEC-5	Skill Enhancement Courses	0	2	2	-	30	20	50	100
Ability Enhancement Courses										
11	SPNC-231	SPORTS	0	0	0	-	-	-	25	25
Total			11	13	24	1025				

Online Courses/ MOOC

Year: II / Semester: IV

S. No	Course Code	Course Name	Credit Hours			Evaluation Scheme				
			L	P	Total Credit	Ext. Theory + Internal Assignment			Final Practical	Total Marks
						EA	IA	PA		
Core Course										
1	AGR-221	Production Technology of Vegetables and Spices	1	1	2	40	20	20	20	100
2	AGR-222	Principles of Agricultural Economics and Farm Management	2	0	2	50	30	20	-	100
3	AGR-223	Crop Production Technology-II (<i>Rabi</i> Crops)	1	2	3	40	20	20	20	100
4	AGR-224	Farm Machinery and Power	1	1	2	40	20	20	20	100
5	AGR-225	Water Management	1	1	2	40	20	20	20	100
6	AGR-226	Problematic Soils & Their Management	1	1	2	40	20	20	20	100
7	AGR-227	Basics of Plant Breeding	2	1	3	40	20	20	20	100
Common course										
9	AGR-228	Agricultural Informatics and Artificial Intelligence	2	1	3	40	20	20	20	100
Skill Enhancement Courses										
10	SEC-6	Skill Enhancement Courses	0	2	2	-	30	20	50	100
Ability Enhancement Courses										
11	SPWC-241	SPORTS	0	1	1	-	-	-	25	25
Total			11	11	22	925				
AIS-221		Internship of 10-weeks duration	10 (0+10) Only for Exit opting students							

Online Courses/ MOOC

Year: III / Semester: V

S. No	Course Code	Course Name	Credit Hours			Evaluation Scheme				
			L	P	Total Credit	Ext. Theory + Internal Assignment			Final Practical	Total Marks
						EA	IA	PA		
Core Course										
1	AGR-311	Agricultural Marketing and Trade	2	1	3	40	20	20	20	100
2	AGR-312	Introduction to Agro-meteorology	1	1	2	40	20	20	20	100
3	AGR-313	Fundamentals of Crop Physiology	2	1	3	40	20	20	20	100
4	AGR-314	Pest management in Crops and Stored Grains	2	1	3	40	20	20	20	100
5	AGR-315	Diseases of Field & Horticultural Crops & their Management	2	1	3	40	20	20	20	100
6	AGR-316	Crop Improvement (<i>kharif</i> crops)-I	1	1	2	40	20	20	20	100
7	AGR-317	Weed Management	1	1	2	40	20	20	20	100
8	AGR-318	Ornamental Crops, MAPs and Landscaping	1	1	2	40	20	20	20	100
9	AGR-319	Introductory Agro forestry	1	1	2	40	20	20	20	100
10	AGR-320	Sheep and Goat Production	1	1	2	40	20	20	20	100
Ability Enhancement Courses										
11	SPNC-351	SPORTS	0	0	0	-	-	-	25	25
Total			14	10	24	1025				

Online Courses/ MOOC

Year: III / Semester; VI

S. No	Course Code	Course Name	Credit Hours			Evaluation Scheme				
			L	P	Total Credit	Ext. Theory + Internal Assignment			Final Practical	Total Marks
						EA	IA	PA		
Core Course										
1	AGR-321	Fundamentals of Agri Biotechnology	2	1	3	40	20	20	20	100
2	AGR-322	Basic and Applied Agricultural Statistics	2	1	3	40	20	20	20	100
3	AGR-323	Crop Improvement (<i>Rabi</i> crops)-II	1	1	2	40	20	20	20	100
4	AGR-324	Renewable energy in Agriculture and Allied Sector	1	1	2	40	20	20	20	100
5	AGR-325	Dry land agriculture/Rainfed agriculture and water shed management	1	1	2	40	20	20	20	100
6	AGR-326	Agricultural Microbiology and Phyto-remediation	1	1	2	40	20	20	20	100
7	AGR-327	Agricultural Finance & Cooperation	1	1	2	40	20	20	20	100
8	AGR-328	Essentials of Plant Biochemistry	2	1	3	40	20	20	20	100
9	AGR-329	Fundamentals of Seed Science & Technology	1	1	2	40	20	20	20	100
Non-gradial course										
10	AGST	**Study Tour	0	2	2	-	-	-	100	100
Ability Enhancement Courses										
11	SPWC-361	SPORTS	0	1	1	-	-	-	25	25
Total			12	10	22	1025				

Online Courses/ MOOC

Year: IV / Semester: VII

S. No	Course Code	Course Name	Credit Hours			Evaluation Scheme				
			L	P	Total Credit	Ext. Theory + Internal Assignment			Final Practical	Total Marks
						EA	IA	PA		
List of Elective Courses (Students may choose any five)										
1	UGE-411	Agri-Business Management	3	1	4	40	20	20	20	100
2	UGE-412	Management of Natural resources	3	1	4	40	20	20	20	100
3	UGE-413	Agrochemicals	3	1	4	40	20	20	20	100
4	UGE-414	Landscaping	3	1	4	40	20	20	20	100
5	UGE-415	Commercial Plant breeding	3	1	4	40	20	20	20	100
6	UGE-416	Food Safety and standards	3	1	4	40	20	20	20	100
7	UGE-417	System Simulation and Agro advisory	3	1	4	40	20	20	20	100
8	UGE-418	Hi-tech Horticulture	3	1	4	40	20	20	20	100
9	UGE-419	Protected cultivation	3	1	4	40	20	20	20	100
10	UGE-420	Biotechnology of Crop Improvement	3	1	4	40	20	20	20	100
11	UGE-421	Micro-propagation Technologies	3	1	4	40	20	20	20	100
12	UGE-422	Commercial Seed Production	3	1	4	40	20	20	20	100
13	UGE-423	Principles and Practices of organic farming/conservation agriculture	3	1	4	40	20	20	20	100
14	UGE-424	Post-Harvest Technology and value addition	3	1	4	40	20	20	20	100
15	UGE-425	Food Science and Nutrition	3	1	4	40	20	20	20	100
16	UGE-426	Organic Livestock Production	3	1	4	40	20	20	20	100
Ability Enhancement Courses										
17	SPWC-471	SPORTS	0	1	1	-	-	-	25	25
Total			15	6	21	525				

Online Courses/ MOOC



Year: IV / Semester: VIII

Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE & AIA)								
Subjects Code	Activities	Credit Hrs			Total Credit	Internal	External	Total
		L	T	P				
RAWE-421	Rural Agricultural Work Experience	0	0	8	8	80	20	100
AIA-422	Agro-Industrial Attachment	0	0	4	4	80	20	100

Experiential Learning Programme: Modules for Skill Development and Entrepreneurship, a student has to register 8 credits opting for one module of (0+8) credits from the package of modules.

Course Code	Title of the module	Credit Hours		Total Credit	Internal	External	Total
		T	P				
ELP-423	Production Technology for Bio-agents and Bio fertilizer	0	8	8	80	20	100
ELP-424	Mushroom Cultivation Technology	0	8	8	80	20	100
ELP-425	Soil, Plant, Water and Seed Testing	0	8	8	80	20	100
ELP-426	Poultry Production Technology	0	8	8	80	20	100
ELP-427	Commercial Horticulture	0	8	8	80	20	100
ELP-428	Food Processing	0	8	8	80	20	100
ELP-429	Organic Manure Production Technology	0	8	8	80	20	100
ELP-430	Fish & Aquaculture	0	8	8	80	20	100

DEPARTMENT/SECTION WISE COURSE BREAKUP AGRONOMY

Name of Course	Credit
Fundamentals of Agronomy	3(2+1)
Farming based livelihood systems	3(2+1)
Crop Production Technology-I (kharif Crops)	3(1+2)
Crop Production Technology-II (kharif Crops)	3(1+2)
Water Management	2 (1+1)
Introduction to Agro-meteorology	2 (1+1)
Weed Management	2 (1+1)
Introductory Agro forestry	2 (1+1)
Dry land agriculture/Rainfed agriculture and watershed management	2 (1+1)
Principles and Practices of natural Farming	2 (1+1)
Soil Science	
Name of Course	Credit
Fundamentals of Soil Science	3(2+1)
Environment Studies and Disaster Management	3 (2+1)
Soil Fertility Management	3(2+1)
Problematic Soils and their management	2 (1+1)
Horticulture	
Name of Course	Credit
Fundamentals of Horticulture	3(2+1)
Production Technology of Fruit and Plantation Crops	2 (1+1)
Production Technology of Vegetables and Spices	2 (1+1)

Ornamental Crops, MAP's and Landscaping	2 (1+1)
Genetics and Plant Breeding	
Name of Course	Credit
Principles of Genetics	3(2+1)
Basics of Plant Breeding	3(2+1)
Crops Improvement (kharif crops)-I	2 (1+1)
Crops Improvement (kharif crops)-II	2 (1+1)
Fundamentals of Seed Science and Technology	2 (1+1)
Entomology	
Name of Course	Credit
Fundamentals of Entomology	3(2+1)
Pest management in crops and stored grains	3(2+1)
Plant pathology	
Name of Course	Credit
Fundamentals of Plant Pathology	3(2+1)
Fundamentals of Nematology	2 (1+1)
Diseases of Field & Horticulture Crops & their Management	3(2+1)
Agricultural Microbiology and Phyto-remediation	2 (1+1)
Agricultural Extension Education	
Name of Course	Credit
Rural Sociology and Educational Psychology	2 (2+0)
Fundamentals of Extension Education	2 (1+1)
Communication Skills	2 (1+1)
Personality development	2 (1+1)
Deeksharambh	2(0+2)
Agricultural Economics	

Name of Course	Credit
Principles of Agricultural Economics and Farm management	2 (2+0)
Entrepreneurship Development and Business Management	3 (2+1)
Agricultural marketing and Trade	2 (1+1)
Agricultural Finance & Cooperation	2 (1+1)
Agricultural Statistics	
Name of Course	Credit
Agricultural Informatics and Artificial Intelligence	3 (2+1)
Basic and Applied Agril Statistics	3 (2+1)
Introductory Mathematics	1 (1+0)
Agricultural Engineering	
Name of Course	Credit
Farm Machinery and Power	2 (1+1)
Renewable energy in Agriculture and Allied Sector	2 (1+1)
Environmental studies and disaster Management	3(2+1)
Biochemistry	
Name of Course	Credit
Essentials of Plant Biochemistry	2 (1+1)
Crop Physiology	
Name of Course	Credit
Fundamentals of Physiology	3 (2+1)
Animal Husbandry	
Name of Course	Credit
Livestock and Poultry Management	2 (1+1)
Livestock Breeding and Nutrition	3(2+1)
Sheep and Goat Production	2(1+1)
Agricultural Bio-technology	

Name of Course	Credit
Fundamentals of Agricultural Bio-technology	3 (2+1)
Students Welfare	
Name of Course	Credit
NCC/NSS	1 (0+1)
NCC/NSS	1 (0+1)
Physical Education, First Aid and yoga Practices	2 (0+2)
Study Tour	2 (0+2)

Types of Courses	Total credits
Common Courses	23
Core Courses	97
Elective Courses	20
Skill Enhancement Courses (indicative)	12
Students READY	20
Other/ Remedial course	3
Total credits for offline course	172
Online courses	10
Grand Total	182

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.	Year: I
Class: B. Sc (Hons) Agriculture	Semester: I
Credits: 2 (non-graded) Theory: 0 Practical: 2	Subject: Agriculture
Course Code: UGF-111	Title: Deeksharambh (Induction-cum-Foundation Programme)
Course Objectives: - To give a broad view and application areas of the subject of study - Helping students from different backgrounds for cultural Integration - Knowing about the operational framework of academic process in university - Instilling life and social skills, leadership qualities, team working spirit - Developing social awareness, ethics and values, creativity - Helping students to identify the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario.	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 0, Practical 2 = 2 Credits	
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)	
Contents	
Discussions on operational framework of academic process in university, as well as interactions with academic and research managers of the University, Creating awareness on the subject of study, and the traditional values and indigenous cultures along with diverse potentialities both in indigenous and developed scenario, Interaction with alumni, business leaders, perspective employers, outstanding achievers in related fields, and people with inspiring life experiences. Group activities to identify the strength and weakness of students (with expert advice for their improvement) as well as to create a platform for students to learn from each other's life experiences, Field visits to related fields/ establishments Sessions on personality development (instilling life and social skills, social awareness, ethics and values, team work, leadership, etc.) and communication skills.	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
Max. Marks	
1. Class tasks/ Sessional Examination	100
2. Presentations /Seminar/Assignments/internal	
3. Practical/Research Project Report/Seminar On Research Project Report	
4. ESE	

Total:	100
Prerequisites for the course:	
Course Learning Outcomes: CO1: Understand the academic culture and structure of the university. CO2: Develop interpersonal and communication skills. CO3: Cultivate self-awareness, cultural empathy, and social responsibility. CO4: Gain insight into traditional and contemporary values. CO5: Build motivation, confidence, and readiness for academic and personal success.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc. (Hons)Agriculture		Semester I
Credits: 2		Subject: Agriculture
Theory: 2		
Practical: 0		
Course Code: AGR-111		Title: Rural Sociology and Educational Psychology
Course Objectives: Provide knowledge on concept and importance of sociology and rural sociology as well as the relationship with Extension Education		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 0 = 2 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Extension Education and Agricultural Extension: Meaning, definition, scope, and importance. Sociology and rural sociology: Meaning, definition, scope, importance of rural sociology in Agricultural Extension, and interrelationship between, sociology, rural sociology and Agricultural Extension. Indian Rural Society: important characteristics, differences and relationship between rural and urban societies.	6
II	Social Groups: Meaning, definition, classification, dynamics, motivation in group formation and role of social groups in Agricultural Extension, SHGs, FPOs and Cooperative. Social Stratification: Meaning, definition, functions, basis for stratification, forms of social stratification- characteristics and- differences between class and caste system, Impact on rural development and agriculture adoption.	6
III	Cultural concepts: culture, customs, folkways, mores, taboos, rituals. Traditions: Meaning, definition and their role in Agricultural Extension. Social Values and Attitudes: Meaning, definition, types and role of social values and attitudes in agricultural Extension. Social Institutions: Meaning, definition, major institutions in rural society, functions, and their role in agricultural Extension.	6
IV	Social Organizations: Meaning, definition, types of organizations, Panchayati raj Institution, SHGs, Farmer groups, cooperative and role of social organizations in agricultural Extension. Social Control: Meaning, definition, need of social control and means of social control. Social change: Meaning, definition, nature of	6

	social change, dimensions of social change and factors of social change. Leadership: Meaning, definition, classification, roles of leader, different methods of selection of professional and lay leaders. Training of Leaders: Meaning, definition, methods of training, Advantages and limitations in use of local leaders in Agricultural Extension.	
V	Digital Rural Society: Internet and Smartphone penetration, digital divide and online communities. Psychology and educational psychology: Meaning, definition, scope, and importance of educational psychology in Agricultural Extension. Intelligence: Meaning, definition, types, factors affecting intelligence and importance of intelligence in Agricultural Extension. Personality: Meaning, definition, types, factors influencing the personality and role of personality in agricultural Extension. Mental Health and Emotional Well- being: meaning, definition and importance in rural population. Behavioural change communication: concept, stage, and strategies for attitude and behaviour change.	6

Reference / Text Books:

1. A. R. Desai -Rural Sociology in India
2. Dahama O. P. and Bhatnagar, O. P. - Education and Communication for Development
3. J.B. Chitambar-Introductory Rural Sociology
4. M.B. Ghorpade-Essential of psychology
5. R Velusamy Textbook on Rural Sociology and Educational Psychology

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	50
4. ESE	
Total:	100

Prerequisites for the course:

Course Outcome:

CO1: Understand the foundational concepts of sociology and rural society relevant to Agricultural Extension.

CO2: Comprehend group dynamics, leadership, and the structure of rural institutions and organizations.

CO3: Develop insights into cultural, social, and psychological factors influencing rural communities.

CO4: Apply knowledge of educational psychology in effective communication and behavioural change among rural populations.

CO5: Integrate digital tools and strategies in modern extension approaches for rural development.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc. (Hons) Agriculture		Semester: I
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-112		Title: Fundamentals of Agronomy
Course Objectives: ● To impart the basic and fundamental knowledge of Agronomy. ● To develop practical skills in field preparation, sowing, and crop management. ● To demonstrate knowledge of tillage and soil management. ● To manage water and nutrients effectively in cropping systems. ● To interpret weed management practices and their significance. ● To utilize agronomic practices for sustainable and efficient farming.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Agronomy and its scope: Definition, meaning and scope of Agronomy; art, science and business of crop production, relation of Agronomy with other disciplines of Agricultural Science, fields crops and classification, importance, ecology and ecosystem. Seeds and sowing: Definitions of crops, variety and seed. Factors affecting crop stands establishment: good quality seed, seed treatment, proper tillage, time of sowing seed rate, depth and method of sowing: broadcasting, drilling, dibbling, transplanting etc. Tillage and tilth: Definition, objectives, types, advantages and disadvantages of tillage including conservation tillage, Crop density and geometry: plant geometry and planting geometry, its effect on growth, yield.	6
II	Crop nutrition: Definition of essential nutrients, criteria of essentiality, functional elements, classification of essential nutrients, role of macro and micro nutrients. Nutrient absorption, active and passive absorption of nutrients, forms of plant nutrients absorbed by plants, Combined /uncombined forms. Manures and fertilizers, nutrient use efficiency: Sources of nutrients: Inorganic (fertilizers),	6

	organic (manures) and bio-fertilizers; their classification and characteristics, method of preparation and role of organic manures in crop production. Integrated Nutrient Management (INM): Meaning, different approaches and advantages of INM. Green manure- role in crop production: Definition, objectives types of green manuring, desirable characteristics, advantages and limitations of green manuring.	
III	Water management: Water resources of the world, India and Uttar Pradesh Soil Moisture constants: gravitational water, capillary water and hygroscopic water, Weeds, its definition, characteristics of weeds, merits and demerits of weeds, classification of weeds, meaning of crop weed competition and its period in different crops.	6
IV	Weeds: Definition, Importance and basics of classification of weeds, Agroclimatic zones of India and U.P., cropping systems: Factors affecting cropping systems, major cropping patterns and systems in the country.	6
V	Sustainable crop production: Definition, importance and practices, natural resources and conservation pollution and pollutants, Allelopathy: Meaning and importance in crop production, Growth and development of crops: Definition, Meaning and factors affecting growth and development.	6
Practical A visit to Instructional Crop farm and study on field crops, Identification of crops, seeds, fertilizers, pesticides, Crops and cropping systems in different Agro-climatic zones of the state, Study of some preparatory tillage implements, Study of inter tillage implements, Practice of ploughing / puddling, Study and practice of inter cultivation in field crops, Numerical exercises on calculation of seed, plant population and fertilizer requirement, Study of yield contributing characters and yield estimation of crops, Identification of weeds in different crops, Seed germination and viability test of seed, Practice on time and method of application of manures and fertilizers.		
Suggested Readings: 1. Chhidda Singh, Modern techniques of raising field crops. Oxford and IBH Publishing Co. Ltd., Bangalore. 2. Gopal Chandra De. 1980., Fundamentals of Agronomy. Oxford and IBH Publishing Co. Ltd., Bangalore, Hand book of Agriculture, ICAR Publication. 3. Palaniappan, S.P., Cropping Systems in the tropics – Principles and Practices. Willey Eastern Ltd., New Delhi. Panda, S.C., 2006. Agronomy Agribios Publication, New Delhi.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40
Total:		100
Prerequisites for the course:		

Course Learning Outcomes:

- Knowledge and concept of different techniques of crop production
- Basics of crop growth in relation to environment and sustainability
- Knowledge of tillage (zero and minimum tillage)
- Basic concepts of crop modelling for maximizing crop yield
- Study of Cropping and farming systems for sustainable agriculture

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: B.Sc (Hons) Agriculture		Year: I Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Agriculture
Course Code: AGR-113		Title: Fundamentals of Soil Science
Course Objectives: 1. To promote professional skills and knowledge about the formation of soil. 2. To build confidence and to find the different layers of soil profile in a particular region. 3. To promote the knowledge about the different physic-chemical properties of soil and the soil orders in India.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Soil: Pedological and edaphological concepts. Rocks and minerals, weathering, Silicate clays: constitution and properties. Classification of Clay minerals and charge of clay minerals. Components of soil.	6
II	Soil formation, Pedogenic processes, Soil profile. Soil forming factors, specific soil formation processes. Podsolization. Calcification, salinization and alkalization.	6
III	Soil profile, soil texture, soil structure. Bulk density and particle density, soil consistency, soil temperature, soil air, soil water. Soil water potential. Classification of soil water.	6
IV	Soil colloids: inorganic and organic, Properties of soil colloids and Ion exchange in soils. Sources of charge, ion exchange, cation and anion exchange capacity and base saturation (after buffering capacity).	6
V	Soil reaction factors affecting soil reactions, and buffering capacity. Soil organic matter. Soil taxonomy, keys to soil orders. Soils of India. soil acidity ,soil alkalinity. Classifications of different soil groups.	6
Practical Study of general properties of minerals, study of minerals-silicate and non-silicate minerals, study of rocks-igneous, sedimentary and metamorphic rocks; study of a soil profile, collection and processing of soil for analysis, study of soil texture-feel method, mechanical analysis, determination particle density and soil porosity, determination of soil colour, study of soil structure and aggregate analysis,		

determination of soil moisture, determination of soil moisture constants field capacity; water holding capacity. Study of infiltration rate of soil, determination of pH and Electrical conductivity of soil.

Reference / Text Books:

1. The Nature and Properties of Soils” by Brady N C.
2. Introductory Soil Science” by Dilip Kumar Das.
3. A Text Book of Soil Science” by Daji A J.
4. Text Book of Soil Science” by Biswas T D and Mukherjee S K.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1. Students will gain knowledge on concepts and principles of Soil Science
CO2. Enable the student to understand the soil, their role, their properties soil forming mineral and development of soil profile.
CO3. Knowledge on advanced instruments in soil analysis was gained
CO4. To provide a better appreciation of the distribution and variability of soils and their properties across the landscape.
CO5. Thorough knowledge on recent advances in Soil Science, Geoinformatics and geospatial techniques in Land Resource Inventory.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : I
Class: B. Sc (Hons) Agriculture		Semester: I
Credits: 3	Subject: Agriculture	
Theory: 2		
Practical: 1		
Course Code: AGR-114		Title: Fundamentals of Horticulture
Course Objectives: 1. To provide knowledge on different branches of Horticulture viz. Pomology, Olericulture, Floriculture and Landscaping, Spices, Medicinal and Aromatic Plants. 2. To provide knowledge on orchard management, propagation methods, cultural operations and nutrient management of horticultural crops 3. To provide knowledge on different physiological aspects of horticultural crops		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Horticulture: Its different branches, importance and scope, botanical classification, soil and climate for horticultural crops.	6
II	Plant propagation: methods and propagation structures, seed dormancy and seed germination, Merits and demerits of sexual and asexual propagation, Root-Stock Management, Stock-scion relationship.	6
III	Principles of orchard establishment, principles and methods of training and pruning of fruit crops,	6
IV	Unfruitfulness in horticultural crops, pollination, pollinizers and pollinators, fertilization and parthenocarpy.	6
V	Importance of bio regulators in horticultural crops, irrigation and its methods, Nutrient Management in horticultural crops. Harvesting and Storage of horticultural produce.	6
Practical Identification and nomenclature of fruit, Layout of an orchard, pit making and system of lanting, Nursery raising techniques of fruit crops, Understanding of plant propagation structures, Propagation through seeds and plant parts, Propagation techniques for horticultural crops, Container, potting mixture, potting and repotting, Training and pruning methods on fruit crops, Preparation of fertilizer mixture and application, Preparation and application of PGR, Layout of different irrigation systems, Maturity studies, harvesting, grading, packaging and storage.		

Reference / Text Books:

1. Instant Horticulture by S. N. Guptha.
2. Basic Horticulture by Jitendra Singh.
3. Glaustas Horticulture by P. Muthu Kumar & Selva Kumar

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

Evaluation/Assessment Methodology

	Max. Marks
• Class tasks/ Sessional Examination	20
• Presentations /Seminar/Assignments/internal	20
• Practical/Research Project Report/Seminar On Research Project Report	20
• ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: The student will be able to understand different branches of horticulture
 CO2: Can demonstrate advanced technologies like training, pruning, etc in horticulture.
 CO3: To enable the students to apply various horticultural skills and knowledge in their career.
 CO4: To identify and prescribe sustainable options in horticulture which benefit the environment while maintaining productivity and economic viability

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme:Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc (Hons) Agriculture		Semester: I
Credits: 2 Theory: 1 Practical: 1		Subject: Communication Skills
Course Code: AGR-115		Title: Communication Skills
Course Objectives: 1. To acquire competence in oral, written, and non-verbal communication. 2. To develop strong personal and professional communication skills. 3. To demonstrate positive and effective group communication.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Communication Process: The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning, types and models of communication; Verbal and non-verbal communication.	3
II	Linguistic and non-linguistic barriers to communication and reasons behind communication gap/ miscommunication.	3
III	Basic Communication Skills: Listening, Speaking, Reading and Writing Skills; Precis writing/ Abstracting/Summarizing; Style of technical communication Curriculum vitae/resume writing; Innovative methods to enhance vocabulary, analogy questions.	3
IV	Structural and Functional Grammar: Sentence structure, modifiers, connecting words and verbals; phrases and clauses; Case: subjective case, possessive case; objective case	3
V	Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles; Agreement of verb with the subject: tense, mood, voice; Writing effective sentences; Basic sentence faults.	3
Practical Listening and note taking; Writing skills: precis writing, summarizing and abstracting; Reading and comprehension (written and oral) of general and technical articles; Micro-presentations and Impromptu Presentations: Feedback on presentations; Stage manners: grooming, body language, voice		

modulation, speed; Group discussions; Public speaking exercises; vocabulary building exercises; Interview Techniques; organization of events.

Reference / Text Books:

1. Allport, G. W. 1937. Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele and Gyles Brandreth. 1994. How to Interview and be Interviewed. Sheldon Press, London.
3. Dale, Carnegie. 1997. The Quick and Easy Way to Effective Speaking. Pocket Books, New York.
4. Francis Peter, S. J. 2012. Soft Skills and Professional Communication. Tata McGraw Hill, New Delhi.
5. Kumar, S and Pushpa Lata. 2011. Communication Skills. Oxford University Press.
6. Neuliep James, W. 2003. Intercultural Communication A Contextual Approach. Houghton Mifflin Co Boston.
7. Pease, Allan. 1998, Body Language. Sudha Publications, Delhi.
8. Raman, M. and Singh, P. 2000. Business Communication. Oxford University Press.
9. Seely, J. 2013. Oxford Guide to Effective Writing and Speaking. Oxford University Press.
10. Thomson, A. J. and Martinet, A. V. 1977. A Practical English Grammar. Oxford University

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- CO1: Understand the process, principles, and barriers of communication.
 CO2: Demonstrate effective oral, written, and non-verbal communication.
 CO3: Apply grammar rules for professional communication.
 CO4: Build skills in public speaking, group discussions, and interviews.
 CO5: Utilize communication tools including modern and digital media in academic and professional settings.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc (Hons) Agriculture		Semester: I
Credits: 3	Subject: Agriculture	
Theory: 2		
Practical: 1		
Course Code: AGR-116		Title: Farming based livelihood systems
Course Objectives: 1. To acquire competence in oral, written, and non-verbal communication. 2. To develop strong personal and professional communication skills. 3. To demonstrate positive and effective group communication.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Status of agriculture in India and different states, Income of farmers and rural people in India, Livelihood-livelihood pattern in urban and rural areas, Different indicators to study livelihood systems. Agricultural livelihood systems (ALS): Meaning, approach, approaches and framework, farming systems and farming based livelihood systems Prevalent Farming systems in India contributing to livelihood.	6
II	Types of traditional and modern farming systems. Components of farming-based livelihood systems- Crops and cropping systems, Livestock (Dairy, Piggery, Goatry, Poultry, Duckry etc.), Horticultural crops, Agro—forestry systems, Aqua culture Duck/Poultry cum Fish, Dairy cum Fish, Piggery cum Fish etc.	6
III	Small, medium and large enterprises including value chains and secondary enterprises as livelihood components for farmers, Factors affecting integration of various enterprises of farming for livelihood. Feasibility of different farming systems for different agro-climatic zones,	6
IV	Commercial farming-based livelihood models by NABARD, ICAR and other organizations across the country, Case studies on different livelihood enterprises associated with the farming. Risk and success factors in farming-based livelihood systems,	6
V	Schemes and programs by Central and State Government, Public and Private organizations involved in promotion of farming-based livelihood opportunities. Role of farming-based livelihood enterprises in 21 st Century in view of circular economy, green economy.	6

Practical

Survey of farming systems and agricultural-based livelihood enterprises, Study of components of important farming- based livelihood models/ systems in different agro-climatic zones, Study of production and profitability of crop based, livestock based, processing based and integrated farming based livelihood models, Field visit of innovative farming system models. Visit of agri-based enterprises and their functional aspects for integration of production, processing and distribution sectors and Study of agri-enterprises involved in industry and service sectors (Value Chain Models), Learning about concept of project formulation on farming-based livelihood systems along with cost and profit analysis, Case study of Start-Ups in agri-sectors.

Reference / Text Books:

1. Allport, G. W. 1937. Personality: A Psychological Interpretation. Holt, New York.
2. Brown Michele and Gyles Brandreth. 1994. How to Interview and be Interviewed. Sheldon Press, London.
3. Dale, Carnegie. 1997. The Quick and Easy Way to Effective Speaking. Pocket Books, New York.
4. Francis Peter, S. J. 2012. Soft Skills and Professional Communication. Tata McGraw Hill, New Delhi.
5. Kumar, S and Pushpa Lata. 2011. Communication Skills. Oxford University Press.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Understand the process, principles, and barriers of communication.

CO2: Demonstrate effective oral, written, and non-verbal communication.

CO3: Apply grammar rules for professional communication.

CO4: Build skills in public speaking, group discussions, and interviews.

CO5: Utilize communication tools including modern and digital media in academic and professional settings

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.	Year: I
Class: B. Sc. (Hons)Agriculture	Semester: I
Credits: 2 Theory: 0 Practical: 2	Subject: Agriculture
Course Code: SEC-114	Title: Animal Feed Management under Natural Farming
Course Objectives: 1. To develop practical skills in preparing and managing natural feed for livestock. 2. To enhance the ability to identify and utilize locally available, eco-friendly feed resources. 3. To build competence in designing cost-effective and sustainable feeding strategies under natural farming systems.	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 0, Practical 2 = 2 Credits	
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)	
Contents (Practical)	No. of Lectures Allotted
Visit to a natural farming livestock unit, Identification of key natural farming principles as applied to animals, Identification of local fodder species (grasses, legumes, tree leaves), Collection, drying, storage practices, Introduction to multi-cut and seasonal fodder crops, Nursery raising and transplantation of Azolla, Napier, cowpea, Demonstration of mixed fodder cropping systems, Organic fodder cultivation using Jeevamrit, Jeevamrit and fermented feed solutions, Herbal mineral mixture using natural ingredients, Preparation of feed blocks and mineral licks (with ash, salt, lime, etc.). Azolla-based feed formulation, Conversion of crop residues into feed, Fermentation techniques using jaggery, curd, herbs, Recycling of fruit/vegetable peels and kitchen waste into animal feed, Feed rationing techniques based on species and production stage, Visit to a certified natural farming livestock unit or farm, Interaction with natural farming practitioners, Feed resource planning at a farm level, Develop and demonstrate a feed plan using available natural resources, Record feed inputs, animal response, and economic assessment.	30
Reference / Text Books: • Organic Livestock Farming in India – ICAR-NIAP, Bengaluru • Handbook of Animal Husbandry – Indian Council of Agricultural Research (ICAR) • Natural Farming: Animal Husbandry – Dr. Vijay Raj Sharma • Azolla Cultivation and Its Use as Livestock Feed – Dr. T. R. Ramesh • Indigenous Technical Knowledge in Animal Husbandry – Dr. M. L. Prajapat	

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	50
4. ESE	-
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Explain the principles of natural farming and their application in animal feed management. CO2: Identify and select locally available natural feed ingredients suitable for various livestock. CO3: Formulate balanced and natural diets for livestock without synthetic inputs. CO4: Prepare low-cost, farm-based feed supplements and mixtures using natural methods. CO5: Demonstrate sustainable feed management practices that promote animal health and reduce environmental impact.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: B. Sc. (Hons)Agriculture	Year : I Semester: I
Credits: 2 Theory: 0 Practical: 2	Subject: Agriculture
Course Code: SEC-126	Title: Organic Production Technology
Course Objectives: 1. To equip learners with the knowledge and skills necessary to practice sustainable agriculture and the production of healthy, organic food. 2. To introduce the concept of organic ecosystem and learn about biological magnification & its significance in present day scenario. 3. To inoculate the importance of doing organic farming as the responsibility of every human being to ensure food safety, nutritional security and food security for the present as well as future generation, to achieve sustainable development for every nation.	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 0, Practical 2 = 2 Credits	
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)	
Contents (Practical)	No. of Lectures Allotted
1. Preparation of enrich compost (Coimbatore method) 2. Preparation of enrich compost (Bangalore method) 3. Preparation of enrich compost (Indore compost) 4. Preparation of of enrich compost (NADEP compost) 5. Preparation of vermicompost and vermi-wash. 6. Multiplication of Azolla 7. Multiplication of Blue Green Algae (BGA) 8. Field preparation and layout 9. Seed inoculation with bio-fertilizer 10. Seed treatment and sowing 11. Preparation of panchagavya 12. Preparation of liquid manure 13. Preparation of Amritpani 14. Preparation of Beejamruth 15. Preparation of Jeevamruth 16. Indigenous technological knowledge (ITK) for weed management 17. Preparation of Ginger, garlic and green chilli extract	30

18. Preparation of Neemastra and Brahmastra 19. Use of pheromone, light trap and yellow sticky trap 20. Indigenous technological knowledge (ITK) for disease management 21. Preparation of fermented butter milk 22. Quality aspect, grading, packaging and handling of organic produce 23. Quality analysis of compost and vermicompost 24. Preparation of balance sheet 25. Waste management 26. Preparation and demonstrate hands on experience on preparation of biofertilizers 27. Identification of green manuring crops and its uses 28. Visit to organic clusters and bio-control labs. 29. Study of post-harvest management in organic farming 30. Economic analysis of organic production system. 31. Case studies of Indigenous Technical knowledge (ITK) for nutrient, insect, pest, 32. disease and weed management.	
Reference / Text Books: • Handbook of agriculture – Indian Council of Agricultural Research (ICAR) • Principles of Organic Farming: Textbook, P. L. Maliwal • Principles of Organic Farming: E Somasundaram, एम. मेयप्पन, D. Udhaya Nandhini	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	50
4. ESE	-
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Studies about organic ecosystem & its concept CO2: To understand about nutrient fortification CO3: Knowledge about nutrient use in organic farming CO4: Organic management of insects, pests, diseases & weeds CO5: Acquainted with National Programme of Organic Product (NPOP) CO6: Knowledge about organic standards & certification CO7: To understand processing, labeling, viability and economics of organic products CO8: To explore marketing potential of organic products.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.	Year: I
Class: B. Sc (Hons) Agriculture	Semester: I
Credits: 1 Theory: 0 Practical: 1	Subject: Agriculture
Course Code: NSS-111	Title: National Service Scheme (NSS-I)
Course Objectives: The primary objective of the National Service Scheme (NSS) is to develop the personality and character of student youth through voluntary community service, with the motto "NOT ME, BUT YOU". It aims to bridge the gap between students and the community, fostering social awareness and responsibility.	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 0 = 1 Credits	
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)	
Introduction and Basic Components of NSS • Orientation: History, Objectives, Principles, Symbol, Badge; Regular Programs under NSS • Organizational structure of NSS, Code of conduct for NSS volunteers, Points to be considered by NSS Volunteers' awareness about Health. • NSS program activities. Concept of regular activities, Special camping, Day camps, Basis of adoption of village/slums, Conducting survey, Analysing Guiding financial patterns of scheme, Youth program/schemes of GOI, Coordination with different agencies and maintenance of diary. Understanding youth. Definition, Profile, Categories, Issues and Challenges of youth; and Opportunities for youth who is agent of the social change. • Community mobilization. Mapping of community stakeholders, Designing the message as per problems and their culture; identifying methods of mobilization involving youth adult partnership. Social harmony and National integration. • Indian history and culture, role of youth in nation building, Conflict resolution and peace building. Volunteerism and Shramdaan. Indian tradition of volunteerism, its need, importance, motivation and constraints; Shaman as part of volunteerism. • Citizenship, Constitution, and Human rights. Basic features of constitution of India, Fundamental rights and duties, Human rights, Consumer awareness and rights and Right to information. Family and Society. Concept of family, Community (PRIs and other community-based organizations) and Society.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.	Year: I
Class: B. Sc (Hons) Agriculture	Semester: I
Credits: 3 Theory: 2 Practical: 1	Subject: Agriculture
Course Code: NCC-111	Title: National Cadet Corps (NCC-I)
Course Objectives: To integrate and develop qualities of leadership, discipline, character and patriotism and foster the NCC Motto: "Unity and Discipline" among the youth.	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 0 = 1 Credits	
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)	
• Aims, Objectives, Organization of NCC and NCC Song. DG's Cardinals of Discipline. • Drill- aim, General words of command, Attention, Stands-at-ease, Stand-easy and Turning. • Sizing, Numbering, Forming in three ranks, Open and Close order march and Dressing. • Saluting at the halt, Getting on parade, Dismissing and Falling-out. • Marching, Length of pace and time of marching in quick/slow time and halt. Side pace, Pace forward and to the rear. Turning on the march and wheeling. Saluting on the march. • Marking time, Forward march and halt. Changing step, Formation of squad and squad drill. • Command and control, Organization, Badges of rank, Honours and Awards. • Nation Building- Cultural heritage, Religions, Traditions and Customs of India. National integration. Values and ethics, Perception, Communication, Motivation, Decision making, Discipline and duties of good citizens. Leadership traits, Types of leadership. Character/ Personality development. Civil defence organization, Types of emergencies, Firefighting, Protection. Maintenance of essential services, Disaster management, Aid during development projects. • Basics of Social Service, Weaker sections of society and their needs, NGO's and their contribution, Contribution of youth towards Social welfare and Family planning. • Structure and Function of human body, Diet and Exercise, Hygiene and Sanitation. Preventable diseases including AIDS, Safe blood donation, First aid, Physical and mental health. Adventure activities. Basic principles of Ecology, Environmental conservation, Pollution and its control.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc. (Hons)Agriculture		Semester: I
Credits: 1		Subject: Agriculture
Theory: 1		
Practical: 0		
Course Code: AGR-117		Title: Introductory Mathematics
Course Objectives: To impart knowledge on Introductory Mathematics as a need-based/ deficiency course.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 0 = 1 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Algebra: Progressions: Arithmetic Progression: Definition, Sum of n terms, Examples. Geometric Progression: Definition, Sum of n terms, Examples. Harmonic Progression: Definitions, Examples. Determinants: Definition of Determinant, Expansion of determinant up to 3rd order, Examples Properties of determinants up to 3rd order (without proof).	3
II	Matrices: Definition of Matrices, Order of Matrix, Types of Matrices, Algebra of Matrices: Addition, Subtraction, Multiplication, Examples, Transpose of Matrix and it's properties (without proof).	3
III	Differential Calculus: Definition, Differentiation of function using first principle, Examples. Rules of Differentiation: Derivatives of sum, Difference, Product and quotient of two functions (Formulae only) and Derivative of Standard functions: Algebraic Function, Trigonometric, Logarithmic and exponential functions (Formulae only), Examples. Increasing and Decreasing Functions, Growth rate, Average Cost and Marginal cost, Marginal Revenue. Examples.	3
IV	Partial Differentiation: Definition, Homogeneous function, Euler's Theorem, Examples. Maxima and Minima of the functions of the form $y = f(x)$ Examples. Integral Calculus: Definition of Indefinite and Definite Integrals, Integrals of elementary functions (Formulae only), Theorems of integration (without proof), Integration by substitution, Examples. Integration by parts, Examples, Application of Integration: to find Area under simple well known curves Simple problems based on it).	3
V	Mensuration: Statement of Simpson's 1/3rd Rule (Without Proof). Examples on Simpson's Rule.	3

Reference / Text Books:

- **Organic Livestock Farming in India** – ICAR-NIANP, Bengaluru
- **Handbook of Animal Husbandry** – Indian Council of Agricultural Research (ICAR)
- **Natural Farming: Animal Husbandry** – Dr. Vijay Raj Sharma
- **Azolla Cultivation and Its Use as Livestock Feed** – Dr. T. R. Ramesh
- **Indigenous Technical Knowledge in Animal Husbandry** – Dr. M. L. Prajapat

Course Learning Outcomes:

CO1: Inculcate critical thinking to carry out scientific investigation objectively without being biased with preconceived notions.

CO2: Equip the student with skills to analyze problems, formulate hypothesis, evaluate and validate results, and draw reasonable conclusions thereof.

CO3: Prepare students for pursuing research or careers in mathematical sciences and allied fields

CO4: Imbibe effective scientific and/or technical communication in both oral and writing.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc. (Hons)Agriculture		Semester: I
Credits: 1		Subject: Agriculture
Theory: 1		
Practical: 0		
Course Code: AGR-118		Title: Introductory Biology
Course Objectives: • To impart foundational knowledge of biological principles including diversity, genetics, evolution of living organisms, • To impart basic knowledge about flowering plants and animals with a focus on their application in Agriculture. • To impart knowledge on Introductory Mathematics as a need-based/ deficiency course.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 0 = 1 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Definition of Biology; Composition and Biological Classification of living world. Definitions: Diversity, Biodiversity; Characteristics of life; Building blocks of life and relationship between different organisms.	3
II	Theories of Origin of Life; Oparin - Haldane Theory of Chemical origin. Evidences of Organic Evolution, Theories of Evolution; Eugenics: Definition. Genetics and Mendel’s Experiments (Basic Concepts), Binomial nomenclature and classification; Overview of taxonomic hierarchy/ ranks.	3
III	Cell structure, Composition and Cell organelles and their functions. Definition, Types: Mitosis and Meiosis, their Significance, Stages. Morphology, Structure and Functions: Roots, Stems, Leaves, Flowers and Fruits.	3
IV	Definitions, Types of seed (Monocot and Dicot seed), Types of seed germination and factors affecting it. Key features, Economic importance and Examples of - A) Brassicaceae B) Fabaceae C) Poaceae	3
V	Livestock in farming systems: Nutritional and economic contributions; Role of pollinators in crop production; Biological pest control (Predatory use); Sustainable	3

integration of animals in agroecosystems.	
Reference / Text Books: • Organic Livestock Farming in India – ICAR-NIAP, Bengaluru • Handbook of Animal Husbandry – Indian Council of Agricultural Research (ICAR) • Natural Farming: Animal Husbandry – Dr. Vijay Raj Sharma • Azolla Cultivation and Its Use as Livestock Feed – Dr. T. R. Ramesh • Indigenous Technical Knowledge in Animal Husbandry – Dr. M. L. Prajapat	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	-
4. ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Inculcate critical thinking to carry out scientific investigation objectively without being biased with preconceived notions.	
CO2: Equip the student with skills to analyze problems, formulate hypothesis, evaluate and validate results, and draw reasonable conclusions thereof.	
CO3: Prepare students for pursuing research or careers in mathematical sciences and allied fields	
CO4: Imbibe effective scientific and/or technical communication in both oral and writing.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc (Hons) Agriculture		Semester: II
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-121		Title: Soil Fertility Management
Course Objectives: 1. To know about different essential elements for the plant growth and development. 2. To manage the soil quality 3. To improve soil health by the judicious uses of manures and fertilizers. 4. The relationship between soil fertility and plant health 5. Goals of a sustainable fertility/soil management program		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	History of soil fertility and plant nutrition. Criteria of essentiality. Forms of nutrients in soil. Role, deficiency and toxicity Symptoms of essential plant nutrients.	6
II	Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of macro and micronutrients.	6
III	Introduction and importance of manures and fertilizers. Fertilizer recommendation approaches. Integrated nutrient management. Preparation and properties of major manures (FYM, Compost, Vermicomposting, Green manuring, Oilcakes).	6
IV	Chemical fertilizers: classification, composition and properties of major fertilizers, secondary and micronutrient fertilizers, Complex fertilizers, Customized fertilizers, water soluble fertilizers nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. Methods of fertilizer recommendations to crops.	6
V	Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Plant analysis, rapid plant tissue tests. Indicator plants. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions. STCR/RTNM/ IPNS, Carbon sequestration and Carbon Trading,	6
Reference / Text Books: 1. Manures and Fertilizes (190), Seventh Edition by K. S. Yawalkar, J. P. Agarwal and S. Bokde		

2. Soil Fertility, theory and practice (1976) by J. S. Kanwar 3. Soil Fertility and Fertilizers (1984) by S.L. Tisdale, W.L. Nelson and J. D. Beaton 4. Fundamentals of Soil (1999) by V. N. Sahai 5. Introductory Soil Science (1999) by D. K. Das.	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: - The students get knowledge about different kind of manures, fertilizers - The students will learn how to maintain the soil health. - The students acquire practical knowledge of nutrient analysis soil.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I	
Class: B. Sc (Hons) Agriculture		Semester: II	
Credits: 3		Subject: Agriculture	
Theory: 2			
Practical: 1			
Course Code: AGR-122		Title: Fundamentals of Entomology	
Course Objectives: 1. To know about different essential elements for the plant growth and development. 2. To manage the soil quality 3. To improve soil health by the judicious uses of manures and fertilizers. 4. The relationship between soil fertility and plant health 5. Goals of a sustainable fertility/soil management program			
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses			
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits			
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)			
Unit	Contents	No. of Lectures Allotted	
I	History of Entomology in India. Major points related to dominance of Insects in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insects with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting.	6	
II	Body segmentation. Structure of head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Metamorphosis and diapause in insects.	6	
III	Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs.	6	
IV	Systematics: Taxonomy – importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order.	6	
V	Classification of class Insecta up to Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae,	6	

	Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.	
Practical 1. Use and handling of common entomological field and laboratory equipments 2. Methods of collection and preservation of insects including immature stages 3. Identification of major insect orders using dichotomous keys and morphological features 4. External features of Grasshopper/Blister beetle; 5. Types of insect antennae, mouthparts and legs; 6. Types of Wing venation, wings and wing coupling apparatus. 7. Types of insect larvae and pupae 8. examination of insect life cycles and metamorphosis types through specimens 9. Dissection of digestive system in insects (Grasshopper) 10. Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.		
Reference / Text Books: 1. Manures and Fertilizers (190), Seventh Edition by K. S. Yawalkar, J. P. Agarwal and S. Bokde 2. Soil Fertility, theory and practice (1976) by J. S. Kanwar 3. Soil Fertility and Fertilizers (1984) by S.L. Tisdale, W.L. Nelson and J. D. Beaton 4. Fundamentals of Soil (1999) by V. N. Sahai 5. Introductory Soil Science (1999) by D. K. Das.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40
Total:		100
Prerequisites for the course:		
Course Learning Outcomes: • The students get knowledge about different kind of manures, fertilizers • The students will learn how to maintain the soil health. • The students acquire practical knowledge of nutrient analysis soil.		

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc. (Hons)Agriculture		Semester: II
Credits: 2 Theory: 1 Practical: 1		Subject: Agriculture
Course Code: AGR-123		Title: Livestock and Poultry Management
Course Objectives: 1. Provide basic knowledge to the students about scientific livestock and poultry rearing practices. 2. Entrepreneurship development through Livestock/poultry and Agriculture Integrated Farming System.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 1Hr. = 1Credit(1Hrs./Week=1Credits) and Practical-1Hr.=1Credit (1Hrs./Week=1Credit)		
Unit	Contents	No. of Lectures Allotted
I	Terminology of Livestock and Poultry, Role of livestock in the national economy, Farming: Specialized Farming, Mixed Farming, and Integrated Farming.	03
II	Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry, Improvement of farm animals and poultry, Reproduction in farm animals and poultry. Clean milk production, milking methods Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals.	03
III	Management of sheep, goat and swine. Incubation, hatching and brooding. Management of chicks, growers and layers. Digestion in livestock and poultry	03
IV	Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry	03
V	Introduction of livestock and poultry diseases like FMD, Mastitis, B.Q., H.S., Anthrax, Brucellosis, Bloat, Milk Fever, Lumpy, Enterotoxaemia, PPR, Swine Fever, Gumbaro, I.B., Ranikhet, C.R.D. Fowl Pox. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.	03
Practical External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk		

production, milking methods. Hatchery operations, incubation and hatching equipment. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

Reference / Text Books:

1. Concept of Animal Husbandry- Deepak Kumar Verma
2. Animal Husbandry and Dairying-. Jagdish Prasad
3. Livestock Production Management- N.S.R. Shastri
4. Text book of Animal Husbandry- G.C. Banerjee-
5. A text Book of Livestock Production management in Tropic by D. N. Verma
6. Practical Handbook of LPM-Deepak Kumar Verma

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Understand the concept and importance of livestock and poultry in the national economy and describe various types of farming systems including specialized, mixed, and integrated farming.
CO2: Identify and distinguish important Indian and exotic breeds of livestock and poultry; explain principles of housing and reproduction; and manage various life stages of farm animals effectively.
CO3: Demonstrate knowledge of management practices for sheep, goat, swine, and poultry (including incubation and brooding), and understand the digestive systems of livestock and poultry.
CO4: Classify feedstuffs, understand the functions of nutrients, and formulate appropriate feeding strategies and rations for different species of livestock and poultry.
CO5: Identify common livestock and poultry diseases, understand their prevention and control measures including vaccination schedules, and apply basic health management practices.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Program: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc. (Hons) Agriculture		Semester: II
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-124		Title: Fundamentals of Plant Pathology
Course Objectives: 1. To get acquainted with the role of different microorganisms in the development of plant disease 2. To get general concepts and classification of plant diseases 3. To get knowledge of general characteristics of fungi, bacteria, virus, and other microorganisms causing plant diseases 4. To acquaint the students with reproduction in fungi, and bacteria, causing plant diseases 5. To get acquainted with various plant disease management principles and practices		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to Plant Pathology: Definition, Scope and Concept; Different terms used in Plant Pathology, History of Plant Pathology with special references to India.	6
II	Causes of plant disease: Inanimate and animate causes; Classification of plant disease; Parasitism and pathogenesis; Disease Triangle, Disease Tetrahedron and Disease cycle.	6
III	Fungi: Definition, morphology, reproduction and classification. Bacteria/phytopathogenic bacteria: Definition, Morphology, reproduction and classification of	6
IV	Other plant pathogens (Definition, morphology and reproduction/ transmission): Mollicutes; Flagellant protozoa; FVB; Green algae and parasitic higher plants; Viruses and viroids, virus.	6
V	Principles of Plant disease management: Disease management with, Cultural and Biological, Chemicals, Host resistance method of Integrated Disease Management (IDM).	6
Practical: 1. Study of the microscope.		

2. Acquaintance with laboratory material and equipment.
3. Preparation of culture media for the Fungi and Bacteria
4. Study of different plant disease symptoms
5. Microscopic examination of general structure of fungi
6. Simple staining of bacteria: Direct and indirect staining, Gram staining of bacteria;
7. Microscopic examination of fungal diseased specimen; Microscopic examination of bacterial diseased specimen
8. Isolation of plant pathogens: Fungi, bacteria and viruses; Purification of plant pathogens
9. Study on plant disease diagnosis: Koch's Postulates
10. Characteristics, formulation, methods of application and calculation on fungicides.

Reference / Text Books:

- Fundamentals of Plant Pathology by B.D Singh
- Principals of Plant Pathology by R.S Singh.
- Plant Bacteriology by Kalyan K. Mondal

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- Upon successful completion of this course/paper, students should be able to:
- Understanding and knowledge of plant disease.
- On successful completion of this course and basing on the diversified course outcomes this course offers a good scope for students in employment sector.
- Acquired knowledge may help the students for predicting crop loss and disease management through various approaches

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B. Sc (Hons) Agriculture		Semester: II
Credits: 2 Theory: 1 Practical: 1		Subject: Personality Development
Course Code: AGR-125		Title: Personality Development
Course Objectives: To make students realize their potential strengths, cultivate their inter-personal skills and Improve employability.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Foundations of individual behavior and factors influencing individual behavior, Models of individual behavior	3
II	Perception and attributes and factors affecting perception, Attribution theory and case studies on Perception and Attribution.	3
III	Learning: Meaning and definition, theories and principles of learning, Learning and organizational behavior, Learning and training, learning feedback.	3
IV	Attitude and values, Intelligence- types of Intelligence, theories of intelligence, measurements of intelligence, factors influencing intelligence, intelligence and Organizational behavior, emotional intelligence.	3
V	Motivation- theories and principles, Teamwork and group dynamics, Maslow’s self-actualization, leadership styles; Conflict management; Case studies in organizational behaviour.	3
Practical: MBTI personality analysis, Learning Styles and Strategies, Motivational needs, Firo-B, Interpersonal Communication, Teamwork and team building, Group Dynamics, Win-win game, Conflict Management, Leadership styles, Case studies on Personality and Organizational Behavior.		
Reference / Text Books: 1. Andrews, Sudhir. 1988. How to Succeed at Interviews. 21st (rep.) New Delhi. Tata McGraw-Hill. 2. Heller, Robert. 2002. Effective Leadership. Essential Manager series. Dk Publishing. 3. Hindle, Tim. 2003. Reducing Stress. Essential Manager series. Dk Publishing. 4. Lucas, Stephen. 2001. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 5. Mile, D.J. 2004. Power of Positive Thinking. Delhi. Rohan Book Company.		

6. Pravesh Kumar. 2005. All about Self- Motivation. New Delhi. Goodwill Publishing House.
7. Smith, B. 2004. Body Language. Delhi: Rohan Book Company.
8. Shaffer, D. R. 2009. Social and Personality Development (6th Edition). Belmont, CA: Wadsworth.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: CO1: Identify key personality theories and their practical relevance. CO2: Analyze personal behavioral patterns using established models. CO3: Apply learning and motivational principles to self-development. CO4: Demonstrate effective interpersonal and team-building skills. CO5: Utilize self-assessment tools to enhance employability and leadership capacity.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: B.Sc (Hons) Agriculture		Semester: II
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-126		Title: Environmental Studies and Disaster Management
Course Objectives:		
1. To expose and acquire knowledge on the environment and to gain the state-of-the-art – skill and expertise on management of disasters.		
2. To enhance the skill and awareness among learners about protection of environment.		
3. To evaluate the environmental issues including pollution and climate change patterns in order to foster the sustainable development		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2		
T: 0		
P: 2 (In Hours/Week)		
Theory - 1 Hr. = 1 Credit		
Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to Environment - Environmental studies: Definition, scope and importance - Multidisciplinary nature of environmental studies - Segments of Environment - Spheres of Earth - Lithosphere - Hydrosphere - Atmosphere - Different layers of atmosphere Natural Resources: Classification - Forest resources. Water resources. Mineral resources Food resources. Energy resources. Land resources. Soil resources.	3
II	Ecosystems: Concept of an ecosystem - Structure and Function of an ecosystem - Energy flow in the ecosystem. Types of ecosystems. Biodiversity and its conservation: Introduction, definition, types. Biogeographical classification of India. Importance and Value of biodiversity. Biodiversity hot spots. Threats and Conservation of biodiversity.	3
III	Environmental Pollution: Definition, cause, effects and control measures of: a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution	3

	g. Light pollution. Solid Waste Management: Classification of solid wastes and management methods, Composting, Incineration, Pyrolysis, Biogas production, Causes, effects and control measures of urban and industrial wastes. Social and Environmental issues. Water conservation, rain water harvesting, watershed management.	
IV	Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Human Population and the Environment: Environment and human health and their rights. Role of Information Technology in Environment and human health.	3
V	Disaster Management: Disaster management: Disaster definition - Types - Natural Disasters - Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, International and National strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community-based organizations and media in disaster management. Central, state, district and local administration in disaster control; Armed forces in disaster response; Police and other organizations in disaster management.	3

Practical

Visit to a local area to document environmental assets river/forest/grassland/hill/mountain. Energy: Biogas production from organic wastes. Visit to wind mill / hydro power / solar power generation units. Biodiversity assessment in farming system. Floral and faunal diversity assessment in polluted and un polluted system. Visit to local polluted site - Urban/Rural/Industrial/Agricultural to study of common plants, insects and birds. Environmental sampling and preservation. Water quality analysis: pH, EC and TDS. Estimation of Acidity, Alkalinity. Estimation of water hardness. Estimation of DO and BOD in water samples. Estimation of COD in water samples. Enumeration of E. coli in water sample. Assessment of Suspended Particulate Matter (SPM). Study of simple ecosystem – Visit to pond/river/hills. Visit to areas affected by natural disaster.

Reference / Text Books:

1. Bharucha, E. 2005. Text book of Environmental Studies for undergraduate courses. University Grants Commission, New Delhi.
2. Anjaneyalu, Y. 2004. Introduction to Environmental Science, BS Publications, Hyderabad, A.P., India.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	

Course Learning Outcomes:

1. Understand the natural environment and its relationships with human activities.
2. Characterize and analyze human impacts on the environment.
3. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
4. Capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels.
5. Capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/ UG(R)/PG/Ph.D.	Year: I
Class: B. Sc. (Hons) Agriculture	Semester: II
Credits: 2 Theory: 0 Practical: 2	Subject: Agriculture
Course Code: SEC-117	Title: Post-harvest Processing Technology
Course Objectives: 1. To understand the importance and methods of post-harvest techniques for foods 2. To gain knowledge in food processing and food conservation	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 0, Practical 2 = 2 Credits	
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)	
Contents	No. of Lectures Allotted
Post-Harvest Handling and Storage 1. Determination of physiological loss in weight (PLW) during storage of fruits/vegetables. 2. Measurement of moisture content in harvested crops using oven and moisture meter methods. 3. Assessment of respiration rate in fruits and vegetables. 4. Determination of maturity indices for fruits like mango, banana, and tomato. 5. Design and demonstration of low-cost storage structures (Zero energy cool chamber / pit storage). 6. Study of mechanical injuries and their effects on quality and shelf-life. Drying and Dehydration Techniques 1. Determination of drying rate and drying time of food materials (e.g., onion, chili, turmeric). 2. Performance evaluation of solar dryer vs. cabinet dryer. 3. Calculation of drying efficiency for hot air dryer. 4. Study of pre-treatments (blanching, osmotic) on drying behavior. 5. Moisture sorption isotherm determination using static gravimetric method. 6. Rehydration ratio and coefficient determination for dehydrated vegetables. Processing and Preservation Methods 1. Preparation and preservation of fruit juice (e.g., citrus, mango). 2. Jam and jelly preparation and analysis (TSS, pH, acidity). 3. Pickle preparation and microbiological evaluation.	30

4. Preparation of RTS (Ready-to-Serve) beverages. 5. Study of chemical preservatives (benzoates, sorbates) on microbial growth. 6. Canning process: blanching, syruping, and can sealing demonstration. Milling and Grading Operations 1. Performance evaluation of grain cleaner and grader. 2. Determination of milling yield and broken percentage in rice milling. 3. Dal milling: dehusking and splitting efficiency evaluation. 4. Determination of physical properties (bulk density, angle of repose, grain size). 5. Wheat flour milling and sieve analysis. 6. Spice grinding: moisture effect and particle size analysis. Packaging and Quality Evaluation 1. Study of different packaging materials and their suitability for perishables. 2. Determination of shelf-life under different packaging conditions. 3. Measurement of mechanical properties of packaging materials (tensile strength, burst resistance). 4. Estimation of nutritional components (protein, ash, crude fiber) in processed products. 5. Sensory evaluation (color, texture, flavor, overall acceptability) of processed foods. 6. Quality analysis of stored products for insect damage, spoilage, or rancidity.		
Reference / Text Books: 1. Bharucha, E. 2005. Text book of Environmental Studies for undergraduate courses. University Grants Commission, New Delhi. 2. Anjaneyalu, Y. 2004. Introduction to Environmental Science, BS Publications, Hyderabad, A.P., India.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40
Total:		100
Prerequisites for the course:		
Course Learning Outcomes:		
CO1: Gain understanding on significance of post-harvest technology. CO2: Understand the processing of cereals and pulses Gain knowledge on different processing and post-harvest loss of fruits and vegetables CO3: Understand the methodologies of different processing and post-harvest loss of animal based foods CO4: Understand the requirement of storage structures in post-harvest technology for plantation crops		

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/ UG(R)/PG/Ph.D. Class: B. Sc. (Hons) Agriculture	Year: I Semester: II
Credits: 2 Theory: 0 Practical: 2	Subject: Artificial Intelligence in Agriculture
Course Code: SEC-129	Title: Artificial Intelligence in Agriculture
Course Objectives: 1. To introduce the fundamentals of Artificial Intelligence (AI) and its relevance to agriculture. 2. To build skills in data-driven agricultural decision-making using AI-based systems. 3. To expose students to real-world applications like precision farming, crop monitoring, and predictive analytics.	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 0, Practical 2 = 2 Credits	
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)	
Contents	No. of Lectures Allotted
Introduction to AI and how it helps Indian farmers, collecting Indian farm data (soil, weather, crop info), cleaning and preparing data using simple tools like Excel or Python, predicting yield of crops like wheat or rice, identifying diseases in crops using images, using AI to tell healthy and sick plants apart, mobile apps for farmers like Plantix and Kisan Suvidha, detecting pests using drone or field images, using data to plan better irrigation, using satellite maps (NDVI) to check crop health, using AI to forecast weather and rainfall, exploring government AI tools for agriculture such as Digital India and eNAM, predicting mandi prices using past data, and a mini project where students choose a problem (e.g., pest attack) and present their solution using AI.	30
Reference / Text Books: 1. "Artificial Intelligence and IoT in Smart Agriculture" – Dr. Utkarsh Shukla 2. "Artificial Intelligence in Agriculture" – R. S. Meena & V. B. Yadav 3. "AI Applications in Agriculture" – Dr. R. K. Kale and Dr. D. B. Gawande 4. "Precision Agriculture using AI and IoT" – Dr. M. A. Jabbar & Dr. G. V. R. Prasada Raju	
Reference / Text Books: 1. Bharucha, E. 2005. Text book of Environmental Studies for undergraduate courses. University Grants Commission, New Delhi. 2. Anjaneyalu, Y. 2004. Introduction to Environmental Science, BS Publications, Hyderabad, A.P., India.	
If the course is available as Generic Elective then the students of following departments may opt it.	

NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Understand basic concepts of Artificial Intelligence, machine learning, and data analytics in the agricultural context.	
CO2: Identify AI tools and technologies used for soil analysis, crop health monitoring, irrigation management, and yield prediction.	
CO3: Analyze agricultural data using AI platforms or software to support decision-making.	
CO4: Demonstrate how AI is applied in precision agriculture, smart farming, and supply chain optimization.	
CO5: Evaluate the potential, limitations, and ethical considerations of AI integration in sustainable agriculture.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.	Year: I
Class: B. Sc (Hons) Agriculture	Semester: II
Credits: 1 Theory: 0 Practical: 1	Subject: Agriculture
Course Code: NSS-112	Title: National Service Scheme (NSS-II)
Course Objectives: To evoke social consciousness among students through various activities viz., working together, constructive, and creative social work, to be skilled in executing democratic leadership, developing skill in program, to be able to seek self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 0, Practical 1 = 1 Credits	
Content (PRACTICAL)	
Practical/ Awareness activities • Importance and role of youth leadership • Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership, Life competencies • Definition and importance of life competencies, problem-solving and decision-making, interpersonal communication. Youth development programs • Development of youth programs and policy at the national level, state level and voluntary sector; youth-focused and youth-led organizations • Health, hygiene and sanitation. Definition needs and scope of health education; role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programs and reproductive health. Youth health, lifestyle, HIV AIDS and first aid. Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid. Youth and yoga. History, philosophy, concept, myths, and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.	Year: I
Class: B. Sc (Hons) Agriculture	Semester: II
Credits: 3	Subject: Agriculture
Theory: 2	
Practical: 1	
Course Code: NCC-112	Title: National Cadet Corps (NCC-II)
Course Objectives: - To develop qualities of character, courage, comradeship, discipline, leadership, secular outlook, spirit of adventure and sportsmanship and the ideals of selfless service among the youth to make them useful citizen. - To create a human resource of organized trained and motivated youth to provide leadership in all walks of life including the Armed Forces and be always available for the service of the nation.	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses	
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits	
National Cadet Corps-II (NCC-II)	
- Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms. Shoulder from the order and vice-versa, present from the order and vice-versa. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice- versa. Guard mounting, guard of honor, Platoon/Coy Drill. - Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning, and sight setting. Loading, cocking, and unloading. The lying position and holding. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing. Characteristics of Carbine and LMG. - Introduction to map, scales, and conventional signs. Topographical forms and technical terms. - The grid system. Relief, contours, and gradients. Cardinal points and finding north. Types of bearings and use of service protractor. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map. Knots and lashings, Camouflage and concealment, Explosives and IEDs. - Field defenses obstacles, mines and mine lying. Bridging, waterman ship. Field water supplies, tracks and their construction. Judging distance. Description of ground and indication of landmarks. Recognition and description of target. Observation and concealment. Field signals. Section formations. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill. Types of communication, media, latest trends and developments.	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks / Sessional Examination / Seminar / Assignments / internal) (Presentations)	100
2. Practical/Research	
3. Project Report/Seminar On Research Project Report	

4. ESE	
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: 1. Understand and explain the fundamental concepts of plant and crop physiology and their significance in agriculture. 2. Identify essential and beneficial mineral nutrients, explain their roles in plant growth, and apply correction methods for nutrient deficiencies. 3. Explain the structure and function of the photosynthetic apparatus and compare the C₃, C₄, and CAM pathways of photosynthesis. 4. Analyse plant growth and development, including measurement methods, photoperiodism, vernalization, senescence, and abscission. 5. Recognize and apply the roles of plant hormones and growth regulators in agricultural practices for improved crop productivity.	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Degree / UG(R)/PG/Ph.D.: PG		Year: I
Class: B. Sc (Hons) Agriculture		Semester: III
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-211		Title: Principles of Genetics
Course Objectives: To make the students acquainted with both principles and practices in the areas of classical genetics, modern genetics, quantitative genetics and cytogenetics.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Mini Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Pre and post Mendelian concepts of heredity, Mendelian principles of heredity, Study of model organisms (Drosophila, Arabidopsis, Garden pea, E. coli, and mice), Architecture of hromosomes, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere, special types of chromosomes, Chromosomal theory of inheritance- cell cycle and cell division-mitosis and meiosis.	6
II	Probabilit and Chi-square. Types of DNA and RNA, Dominance relationships, Epistatic interactions with example, Introduction and definition of cytology, genetics and cytogenetics and their interrelation.	6
III	Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanism, chromosome mapping.	6
IV	Structural and numerical variations in chromosomes and their implications, Use of haploids, dihaploids and double haploids in Genetics, Mutation, classification, Methods of inducing mutations, mutagenic agents and induction of mutation.	6
V	Qualitative and quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance, Nature, structure and replication of genetic material, Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation	6
Practical Study of microscope, Study of cell structure, Mitosis and Meiosis cell division, Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross. Experiments on epistatic interactions		

including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and chi-square test, Determination of linkage and croo-over analysis (through two point test cross data), Study on sex linked inheritance in Drosophila. Study on models on DNA and RNA structures.

Reference / Textbooks:

1. Fundamentals of Genetics: B. D. Singh
2. Genetics: M. W. Strickberger.
3. Principles of Genetics: Gardner, Simmons and Snustad.
4. Principles of Genetics: Sinnott, Dunn and Dobzhansky

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

- 1.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Mendelian Genetics: Grasp laws of inheritance, gene interactions, deviations, linkage, and crossing over.

CO2: Molecular Basis: Understand DNA structure, replication, transcription, translation, and gene expression.

CO3: Chromosomal Genetics: Comprehend chromosome structure, sex determination, and chromosomal changes.

CO4: Genetic Variation & Evolution: Recognize how new variation arises (mutation, recombination) and its role in evolution.

CO5: Genetic Diseases: Understand molecular basis of diseases, inheritance patterns, and diagnostic approaches

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: II
Class: B.Sc (Hons) Agriculture		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Agriculture
Course Code: AGR-212		Title: Crop Production Technology-I (Kharif crops)
Course Objectives: 1. To impart basic and fundamental knowledge on principles and practices of kharif crop production 2. To impart knowledge and skill on scientific crop production and management		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Rice nursery preparation, transplanting of rice, sowing of soybean, pigeon pea and mungbean, maize, groundnut and cotton, effect of seed size on germination and seedling vigour of Kharif crops.	6
II	Effect of sowing depth on germination of Kharif crops, identification of weeds in Kharif crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of Kharif crops.	6
III	Study of crop varieties and important agronomic experiments at experiential farm, recording biometric observations	6
IV	Study of forage experiments, morphological description of Kharif crops, silage and hay making, visit to research centres of related crops.	6
V	*Practical Crop Production- One (1) credit from practical of the course is allotted for Practical Crop Production of selected kharif crops covered under this course.	6
Reference / Text Books:		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20

3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: • Students will be able to know about Soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. • Constraints in production of oilseeds and pulses maybe identified through course content. • Students will be acquainted with the knowledge of profitable crop production technology. • Production technology of kharif cereals and millets fulfil the need of human consumption and milch cattle	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Degree / UG(R)/PG/Ph.D.: PG		Year: II
Class: B. Sc (Hons) Agriculture		Semester: III
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-213		Title: Production Technology of Fruit and Plantation Crops
Course Objectives: 1. To educate about the different forms of classification of fruit crops 2. To educate about the origin, area, climate, soil, improved varieties and cultivation practices of fruit and plantation crops 3. To educate about the physiological disorders of fruit crops, palms and plantation crops		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Production status of fruit and plantation crops: Importance and scope of fruit and plantation crop industry in India; nutritional value of fruit crops; classification of fruit crops; area, production, productivity and export potential of fruit and plantation crops.	6
II	Crop production techniques in tropical, sub-tropical and temperate fruit crops: Climate and soil requirements, varieties, propagation and use of rootstocks, planting density and systems of planting: High density and ultra-high density planting, cropping systems, after care – training and pruning; water, nutrient and weed management, fertigation, special horticultural techniques, plant growth regulation, important disorders, maturity indices and harvest, value addition.	6
III	Fruit crops: mango, banana, papaya, guava, sapota, citrus, grape, litchi, pineapple, pomegranate, apple, pear, peach, strawberry, nut crops Jackfruit and minor fruits- date, ber, apple, plantation crops-coconut, arecanut, cashew, tea, coffee and rubber.	6
IV	Crop production techniques in palms and plantation crops: Climate and soil requirements, varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity	6

	indices, harvest and yield, pests and diseases, processing- value addition	
V	Palms: Coconut, Arecanut, Oil palm and Palmyrah, Plantation crops: Tea, Coffee, Cocoa, Cashewnut, Rubber.	6

Practical

Propagation techniques, selection of planting material, varieties, important cultural practices for mango, banana, papaya, guava, sapota, grapes, Citrus (mandarin and acid lime), pomegranate, jackfruit, preparation and application of PGR's for propagation, Micro propagation, protocol for mass multiplication and hardening of fruit crops, Identification and description of varieties, mother palm and seed nut selection, nursery practices, seedling selection, fertilizers application, nutritional disorders, pests and diseases of Coconut, Arecanut and cocoa, Tea and coffee, Rubber and cashew, Visit to commercial orchard and plantation industries.

Reference / Textbooks:

1. Banday, F.A. and Sharma, M.K. 2010 Advances in temperate fruit production. Kalyani Publishers, Ludhiana
2. Bose, T.K., S.K. Mitra and D. Sanyal 2001. Fruits: Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
3. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi
4. Chadha, T.R. 2001 Textbook of temperate fruits. ICAR, New Delhi
5. Chattopadhyay, T.K. 2001. A Text Book on Pomology (4 volumes). Kalyani Publishers, Ludhiana.
6. Chattopadhyay. 1998. A textbook on pomology (sub-tropical fruits) vol.III. Published by M/s. Kalyani publishers, Ludhiana, New Delhi, Noida. UP.
7. Chudawat, B. S. 1990. Arid fruit culture Oxford & IBH, New Delhi
8. Das, B.C. and Das S.N. Cultivation of minor fruits. Kalyani Publishers, Ludhiana
9. David Jackson and N.E. Laone, 1999. Subtropical and temperate fruit production. CABI publications
10. H.P. Singh and M.M. Mustafa 2009. Banana-new innovations Westville publishing House, New Delhi
11. Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, Tamil Nadu..
12. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
13. Radha, T. and Mathew, L. 2007. Fruit crops. New India publishing Agency
14. Rajput, CBS and Srihari babu, R. 1985. Citriculture, Kalyani Publishers, Ludhiana

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

1.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- Students will be able to know define importance and scope of fruit and plantation crop industry in India, concepts of production for fruit and plantation crops, new planting system and methods, soil and climatic requirement of different fruit and plantation crops, etc.
- Students will understand various concepts of high density planting, new techniques of high density

planting, plant propagation, seed propagation, etc.

- Demonstrate preparation and application of plant growth regulators to the crops, etc. Investigate the various problems with the production technology of fruit and plantation crops such as disorder, diseases and pests, etc
- To distinguish different fruits and plantation crops, symptoms of disorders, diseases, insects and pests, etc.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Degree / UG(R)/PG/Ph.D.: PG		Year: II
Class: B. Sc (Hons) Agriculture		Semester: III
Credits: 2		Subject: Agriculture
Theory: 1		
Practical: 1		
Course Code: AGR-214		Title: Fundamentals of Extension Education
Course Objectives: 1 State the importance of extension education in agriculture 2. Familiarize with the different types of agriculture and rural development programs launched by govt. of India 3. Classify the types of extension teaching methods 4. Elaborate the importance and different models of communication 5. Explain the process and stages of adoption along with adopters' categories		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 1 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Education: Meaning, definition and Types; Extension Education: meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning: eaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.).	6
II	Reorganised Extension System (T&V system) various extension/ agriculture development programs launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.). Social Justice and poverty alleviation programme: ITDA, IRDP/SGSY/NRLM. Women Development Programme: RMK, MSY etc. New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc., Attributes of Innovation, DWCRA, Commodity Interest Groups (CIGs)., Farmers Producer Group (FPG).	6
III	Rural Development: concept, meaning, definition; various rural development programs launched by Govt. of India. Community Development: meaning, definition, concept and principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; Method of identification of Rural Leader.	6

IV	Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programs; transfer of technology: concept and models, capacity building of extension personnel; extension teaching methods: meaning, classification, individual, group and mass contact methods.	6
V	ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.	6

Practical

To get acquainted with university extension system. Group discussion- exercise; Identification of rural leaders in village situation; preparation and use of AV aids, preparation of extension literature (leaflet, booklet, folder, pamphlet news stories and success stories); Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA/PRI and other development departments at district level; visit to NGO/FO/FPO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Reference / Textbooks:

1. Adivi Reddy, A. 2001. Extension Education, Sree Lakshmi press, Bapatla.
2. Dahama, O. P. and Bhatnagar, O.P. 1998. Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
3. Jalihal, K. A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
4. Muthaiah Manoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).
5. Sagar Mondal and Ray, G. L., Text Book on Rural Development, Entrepreneurship and Communication Skills, Kalyani Publications.
6. Rathore, O. S. et al. 2012. Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
7. Dudhani, C.M., Hirevenkatgoudar, L.V., Manjunath, L. Hanchinal, S.N. and Patil, S.L. 2004. Extension Teaching Methods and Communication Technology, UAS, Dharwad.
8. Sandhu, A.S. 1993. Text book on Agricultural Communication: Process and Methods. Oxford and IBH Publishing Pvt. Ltd, New Delhi.
9. Singh, A.K., Lakhan Singh, R. and Roy Burman. 2006. Dimensions of Agricultural Extension. Aman Publishing House, Meerut

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20

2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- Education; Extension Programme planning Meaning, Process, Principles and Steps in Programme Development.
- Extension systems in India: Extension efforts in Pre-independence era.
- New trends in agriculture extension: privatization extension.
- Monitoring and evaluation – concept and definition, monitoring, and evaluation of Extension programmes, Transfer of Technology- Concept and models.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Degree / UG(R)/PG/Ph.D.: PG		Year: II
Class: B. Sc (Hons) Agriculture		Semester: III
Credits: 2		Subject: Agriculture
Theory: 1		
Practical: 1		
Course Code: AGR-215		Title: Fundamentals of Nematology
Course Objectives: 1. To impart knowledge on history, economic importance of plant parasitic nematodes, morphology, biology, host parasitic relationship of nematodes. 2. To impart knowledge on nematode pests of different crops of national and local importance and their management.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L:1 T: 0 P: 2 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction: History of phytonematology, habitat and diversity, economic importance of nematodes. General characteristics of plant parasitic nematodes.	6
II	Nematode: definition, general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of nematodes on the basis of feeding/ parasitic habit.	6
III	Symptomatology, role of nematodes in disease development, Interaction between plant parasitic nematodes and disease-causing fungi, bacteria and viruses.	6
IV	Nematode pests of crops: Rice, wheat, vegetables, pulses, oilseed and fiber crops, citrus and banana, tea, coffee and coconut.	6
V	Different methods of nematode management: Cultural methods, physical; methods, Biological methods, Chemical methods, Plant Quarantine, Plant resistance and INM.	6
Practical To get acquainted with university extension system. Group discussion- exercise; Identification of rural leaders in village situation; preparation and use of AV aids, preparation of extension literature (leaflet, booklet, folder, pamphlet news stories and success stories); Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA/PRI and other development departments at district level; visit to NGO/FO/FPO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to		

mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Reference / Textbooks:

1. Economic Nematology-Edited by J.M. Webster
2. Plant Parasitic Nematodes (Vol-1) by Zukerman, Mai, Rohde
3. Plant Parasitic Nematodes of India: Problems and Progress by - Gopal Swarup, D. R. Dasgupta, P. K. Koshy.
4. Text book on Introductory Plant Nematology -R.K. Walia and H.K. Bajaj

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar on Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

Upon successful completion of this course/paper, students should be able to:

1. Explain the historical significance, ecological diversity, and economic impact of plant-parasitic nematodes in agriculture.
2. Describe the morphology, biology, and classification of nematodes, focusing on economically important families and feeding habits.
3. Diagnose nematode-induced symptoms and analyze their role in disease complexes with fungi, bacteria, and viruses.
4. Identify major nematode pests associated with key crops (e.g., Meloidogyne in vegetables, Heterodera in cereals) and their damage patterns.
5. Evaluate integrated nematode management strategies (cultural, biological, chemical, host resistance, and INM) for sustainable crop protection.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Degree / UG(R)/PG/Ph.D.: PG		Year: II
Class: B. Sc (Hons) Agriculture		Semester: III
Credits: 2	Subject: Agriculture	
Theory: 1		
Practical:1		
Course Code: AGR-216		Title: Principles and Practices of Natural Farming
Course Objectives: 1. To provide comprehensive understanding and knowledge to students about natural farming. 2. To teach students the concept, need and principles of native ecology-based production under natural farming. 3. To impart practical knowledge of natural farming and related agricultural practices in Indian and global environmental and economic perspectives.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: T: 92 P: 103 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Indian Heritage of Ancient Agriculture, History of Natural Farming, Importance of natural farming in view of climate change, soil health, water use carbon sequestration, biodiversity conservation, food security and nutritional security, and sustainable development goals (SDGs), Concept of natural farming; Definition of natural farming; Objective of natural farming, Essential characteristics and Principles of natural farming; Scope and importance of natural farming.	6
II	Main Pillars of natural farming; Methods/ types/schools of natural farming. haracteristics and design of a natural farm, Concept of ecological balance, ecological engineering and community responsibility in natural versus other farming systems, Introduction to concept of ecological, water, carbon and nitrogen foot prints.	6
III	Concept and evaluation of ecosystem services, integration of crops, trees and animals, cropping system approaches, Biodiversity, indigenous seed production, farm waste recycling, water conservation and renewable energy use approaches on a natural farm, Rearing practices for animals under natural farming.	6
IV	Nutrient management in natural farming and their sources, Insect, pest, disease and weed management under natural farming; Mechanization in natural farming, Processing, labelling, economic considerations and viability, certification and standards in natural farming, marketing and export potential of natural farming	6

	produce and products	
V	Initiatives taken by Government (central/state), NGOs and other organizations for promotion of natural farming and chemical free agriculture, Case studies and success stories in natural farming and chemical free traditional farming, Entrepreneurship opportunities in natural farming.	6

Practical

Visit of natural farm and chemical free traditional farms to study the various components and operations of natural farming principles at the farm; Indigenous technical knowledge (ITK) for seed, tillage, water, nutrient, insect-pest, disease and weed management; On-farm inputs preparation methods and protocols, Studies in green manuring in-situ and green leaf manuring, Studies on different types of botanicals and animal urine and dung based non-aerated and aerated inputs for plant growth, nutrient, insect and pest and disease management; Weed management practices in natural farming; Techniques of Indigenous seed production- storage and marketing, Partial and complete nutrient and financial budgeting in natural farming; farming; Evaluation of ecosystem services in natural farming (Crop, Field and System).

Reference / Textbooks:

1. Ayachit, S.M. 2002. Kashyapi Krishi Sukti (A Treatise on Agriculture by Kashyapa). Brig Sayeed Road, Secunderabad, Telangana: Asian Agri-History Foundation 4: 205.
2. Ecological Farming -The seven principles of a food system that has people at its heart. May 2015, Greenpeace.
3. FAO. 2018. The 10 elements of agro-ecology: guiding the transition to sustainable food and agricultural system. <https://www.fao.org/3/i9037en/i9037en.pdf> Agro ecosystem Analysis for Research and Development Gordon R. Conway.1985.
4. Fukuoka, M. 1985. The Natural Way of Farming: The Theory and Practice of Green Philosophy. Japan Publications, Tokyo, 280 pp.
5. Natural Farming Techniques: Farming without tilling by Prathapan Paramu (2021)
6. Plenty for All: Natural Farming A to Z Prayog Pariwar Methodology by Prof. Shripad A. Dabholkar and Prayog Pariwar Prayog Pariwar (2021)
7. Reyes Tirado. 2015. Ecological Farming- The seven principles of a food system that has people at its heart. Greenpeace Research laboratories. University of Exeter, Ottho Heldringstraat.
8. Shamasastri, R. 1915. Kautilya's Arthashastra.
9. The Ultimate Guide to Natural Farming and Sustainable Living: Permaculture for Beginners (Ultimate Guides) by Nicole Faires (2016)

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- **Understanding:** Grasp the science behind natural farming, its ecological benefits, and its role in food security.
- **Skill Development:** Learn to prepare natural inputs (concoctions), manage diverse crops, and control pests organically.
- **Transitioning:** Gain the ability to convert from conventional to natural farming practices.
- **Sustainability:** Create farming systems that are economically viable, environmentally friendly, and climate-resilient.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Degree / UG(R)/PG/Ph.D.: PG		Year: II
Class: B. Sc (Hons) Agriculture		Semester: III
Credits: 2		Subject: Agriculture
Theory: 1		
Practical: 1		
Course Code: AGR-217		Title: Livestock Breeding and Nutrition
Course Objectives: 1. To impart knowledge on history, economic importance of plant parasitic nematodes, morphology, biology, host parasitic relationship of nematodes. 2. To impart knowledge on nematode pests of different crops of national and local importance and their management.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: T: 92 P: 103 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Brief history of domestication of livestock. Important breeds of cattle, buffalo, sheep, goats and pigs with special reference to their economic characters. Animal Breeding Programmes/ Schemes in India: Key Village Scheme, Intensive Cattle Development Projects,	6
II	All India Coordinated Research Project on farm animals, Progeny Testing Programmes. National Breeding Policy in India. Role of information technology in Animal Breeding.	6
III	Animal Nutrition- Definition and importance. Nutrients: Classification and role in animal body. Nutritional importance of minerals and vitamins and their sources, deficiency symptoms and requirements. Digestive system of ruminant	6
IV	Feed stuffs: Classification and their nutritive value, desirable characteristics of good ration, Rationing of animals- Balanced, maintenance, production and ideal ration. Feeding standards- classification, history and limitations. Nutritional requirements for dairy animals.	6
V	Preparation of balanced ration for different categories of cattle and buffaloes. Feeding practices for dairy animals. Feeding of goats, Sheep and Swine – principles of feeding, feed stuffs, nutritional requirements, feed formulation and feeding practices.	6
Practical 1. Identification of tools used in animal breeding, 2. Familiarity with different breeding records		

3. Identification of feedstuffs- Roughages and concentrates.
4. Computation of balanced ration for dairy herd.
5. Formulation of ration for goats, sheep and swine.
6. Cropping scheme for supply of green fodder round the year
7. Preparation of concentrate mixture- mixing of feeds
8. Feeding systems

Reference / Textbooks:

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

1. Understand the principles of breeding farm livestock
2. Understand techniques used to enhance livestock reproduction
3. Be able to formulate a ration for selected livestock
4. Be able to evaluate the effectiveness of a feeding plan

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: II
Class: B.Sc (Hons) Agriculture		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Agriculture
Course Code: AGR-218		Title: Entrepreneurship Development and Business Management
Course Objectives: 1. To provide students an insight into the concept and scope of entrepreneurship. 2. To expose students to various aspects of establishing and managing a small business unit. 3. To enable students to develop financially viable agribusiness proposals.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Development of entrepreneurship, motivational factors, social factors, environmental factors, characteristics of entrepreneurs, entrepreneurial attributes/competencies. Concept, need for and importance of entrepreneurial development. Evolution of entrepreneurship, objectives of entrepreneurial activities, types of entrepreneurs, functions of entrepreneurs, importance of entrepreneurial development, and process of entrepreneurship development.	6
II	Environment scanning and opportunity identification need for scanning–spotting of opportunity-scanning of environment– identification of product / service – starting a project; factors influencing sensing the opportunities.	6
III	Infrastructure and support systems-good policies, schemes for entrepreneurship development; role of financial institutions, and other agencies in entrepreneurship development. Steps involved in functioning of an enterprise. Selection of the product / services, selection of form of ownership; registration, selection of site, capital sources, acquisition of manufacturing know how, packaging and distribution.	6
IV	Planning of an enterprise, project identification, selection, and formulation of project; project report preparation, Enterprise Management. Production management – product, levels of products, product mix, quality control, cost of production, production controls, Material management. Production management – raw material costing, inventory control. Personal management–manpower	6

	planning, labour turn over, wages / salaries.	
V	Financial management / accounting–funds, fixed capital and working capital, costing and pricing, long term planning and short-term planning, book keeping, journal, ledger, subsidiary books, annual financial statement, taxation. Marketing management- market, types, marketing assistance, market strategies. Crisis management- raw material, production, leadership, market, finance, natural etc.	6

Reference / Text Books:

1. Charantimath, P.M. (2009). *Entrepreneurship Development and Small Business Enterprises*. Pearson Publications, New Delhi.
2. Desai, V. (2015). *Entrepreneurship: Development and Management*. Himalaya Publishing House.
3. Desai, Vasant. (1997). *Small Scale Industries and Entrepreneurship*. Himalaya Publ. House.
4. Grover, Indu. (2008). *Handbook on Empowerment and Entrepreneurship*. Agrotech Public Academy.
5. Gupta, C.B. (2001). *Management Theory and Practice*. Sultan Chand & Sons.
6. Khanka, S.S. (1999). *Entrepreneurial Development*. S. Chand & Co.
7. Mehra, P. (2016). *Business Communication for Managers*. Pearson India, New Delhi.
8. Pandey, M. & Tewari, D. (2010). *The Agribusiness Book*. IBDC Publishers, Lucknow.
9. Singh, D. (1995). *Effective Managerial Leadership*. Deep & Deep Publ.
10. Singhal, R.K. (2013). *Entrepreneurship Development & Management*. Katson Books.
11. Tripathi, P.C. & Reddy, P.N. (1991). *Principles of Management*. Tata 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
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- CO1: Understand entrepreneurial attributes and the process of starting a business.
CO2: Apply tools for environmental scanning and opportunity analysis.
CO3: Develop a feasible business plan for agri-enterprise establishment.
CO4: Apply concepts of production, marketing, and financial management.
CO5: Develop soft skills in leadership, risk assessment, and crisis management through field exposure.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Degree / UG(R)/PG/Ph.D.: PG		Year: II
Class: B. Sc (Hons) Agriculture		Semester: III
Credits: 2		Subject: Agriculture
Theory: 0		
Practical: 2		
Course Code: AGR-219		Title: Physical Education, First Aid, Yoga Practices and Meditation
Course Objectives: • To make the students aware about Physical Education, First Aid and Yoga Practices. • To disseminate the knowledge and skill how to perform physical training, perform first aid and increase stamina and general wellbeing through yoga.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 0, Practical 2 = 2 Credits		
L:2 T: 0 P: 1 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Physical education; Training and Coaching - Meaning and Concept; Methods of Training; aerobic and aerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory and Digestive systems; Balanced Diet and Nutrition: Effects of Diet on Performance; Physiological changes due to ageing and role of regular exercise on ageing process; Personality, its dimensions and types; Role of sports in personality development; Motivation and Achievements in Sports; Learning and Theories of learning; Adolescent Problems and its Management; Posture; Postural Deformities; Exercises for good posture. Yoga; History of Yog, Types of Yog, Introduction to Yog, • Asanas (Definition and Importance) Padmasan, san, Vajrajasan, Shashankasan, Pashchimotasan, Ushtrasan, Tadasan, Padhastasan, Ardchchandrasan, Bhujangasan, Utanpadasan, Sarvangasan, Parvatasan, Patangasan, Shishupalanasan – left leg-right leg, Pavanmuktasan, Halasan, Sarpasan, Ardhhdhanurasan, Sawasan • Suryanamskar Pranayama (Definition and Importance) Omkar, Suryabhedan, Chandrabhedan, Anulom Vilom, Shitali, Shitkari, Bhastrika, Bhramari • Meditation (Definition and Importance), Yogic Kriyas (Kapalbhati), Tratak, Jalneti and Tribandh	30

	• Mudras (Definition and Importance) Gyanmudra, Dhyanmudra, Vayumudra, Akashmudra, Pruthvimudra, Shunyamudra, Suryamudra, Varunmudra, Pranmudra, Apanmudra, Vyanmudra, Uddanmudra Role of yoga in sports • Teaching of Asanas – demonstration, practice, correction and practice. • History of sports and ancient games, Governance of sports in India; Important national sporting events; Awards in Sports; History, latest rules, measurements of playfield, specifications of equipment, skill, technique, style and coaching of major games (Cricket, football, table Tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho) and Athletics • Need and requirement of first aid. First Aid equipment and upkeep. First aid Techniques, First aid related with Respiratory system. First aid related with Heart, Blood and Circulation. First aid related with Wounds and Injuries. First aid related with Bones, Joints Muscle related injuries. First aid related with Nervous system and Unconsciousness. First aid related with Gastrointestinal Tract. First aid related with Skin, Burns. First aid related with Poisoning. First aid related with Bites and Stings. First aid related with Sense organs, Handling and transport of injured traumatized persons. Sports injuries and their treatments.	
Reference / Textbooks:		
If the course is available as Generic Elective, then the students of the following departments may opt for it. 1. 2. 3.		
Evaluation/Assessment Methodology		
	Max. Marks	
1) Class tasks/ Sessional Examination	30	
2) Presentations /Seminar/Assignments/internal	20	
3) Practical/Research Project Report/Seminar on Research Project Report	-	
4) ESE	50	
Total:		100
Prerequisites for the course:		
Course Learning Outcomes:		
• Assess & Improve Fitness: Evaluate personal fitness levels (BMI, endurance, strength) and participate in activities to improve them. • Understand Principles: Grasp biomechanical and physiological principles behind exercise. • Develop Skills: Enhance strength, flexibility, balance, and coordination through sports and yogic movements.		

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Degree / UG(R)/PG/Ph.D.: PG		Year: II
Class: B. Sc (Hons) Agriculture		Semester: III
Credits: 2		Subject: Agriculture
Theory: 0		
Practical: 2		
Course Code: SEC		Title: Seed Production and Testing Technology
Course Objectives: To equip students with knowledge and skills to produce, process, test, and certify high-quality seeds, ensuring genetic purity and viability for increased agricultural production, covering seed development, hybrid production, certification standards (like ISTA), processing, storage, and marketing, to foster successful careers in the seed industry or entrepreneurship		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 0, Practical 2 = 2 Credits		
L: T: 92 P: 103 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Planning of Seed Production, requirements for different classes of seeds in field crops - unit area and rate; Seed production in cross pollinated crops with special reference to land, isolation, planting ratio of male and female lines, synchronization of parental lines and methods to achieve synchrony; supplementary pollination, pollen storage, hand emasculation and pollination in Cotton, detasseling in Corn, identification of rogues and pollen shedders; Pollen collection, storage, viability and stigma receptivity; gametocide application and visits to seed production plots etc. Structure of monocot and dicot seeds of important plant species; identification and handling of instruments used in seed testing laboratory; identification of seeds of weeds and crops; physical purity analysis of samples of different crops; estimation of seed moisture content (oven method); seed dormancy breaking methods requirements for conducting germination test, specifications and proper use of different substrata for germination; seed germination testing in different agri-horticultural crops; seedling evaluation; viability testing by tetrazolium test in different crops; seed and seedling vigour tests applicable in various crops; species & cultivar identification; genetic purity testing by chemical, biochemical and molecular methods; seed health testing for designated diseases, blotter methods, agar method and embryo count methods; testing coated/pelleted seeds.	30
Reference / Textbooks:		

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar on Research Project Report	50
4) ESE	-
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- Understand principles of seed multiplication (nucleus, breeder, foundation, certified) and generation systems.
- Apply agronomic practices for quality seed production in self, cross, and hybrid crops.
- Implement techniques for hybrid seed development (e.g., male sterility, self-incompatibility).
- Manage isolation requirements, pollinators, rouging, and field inspection

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: IV

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: II
Class: B.Sc (Hons) Agriculture		Semester: IV
Credits: 2 Theory: 1 Practical: 1		Subject: Agriculture
Course Code: AGR-221		Title: Production Technology of Vegetables and Spices
Course Objectives: 1. To educate about the different forms of classification of vegetables. 2. To educate about the origin, area, climate, soil, improved varieties and cultivation practices of vegetables and spices. 3. To educate about the physiological disorders of vegetables and spices..		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02 T: 00 P: 02 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Production status of fruit and plantation crops: Importance and scope of fruit and plantation crop industry in India; nutritional value of fruit crops; classification of fruit crops; area, production, productivity and export potential of fruit and plantation crops.	6
II	Crop production techniques in tropical, sub-tropical and temperate fruit crops: Climate and soil requirements, varieties, propagation and use of rootstocks, planting density and systems of planting: High density and ultra-high density planting, cropping systems, after care – training and pruning; water, nutrient and weed management, fertigation, special horticultural techniques, plant growth regulation, important disorders, maturity indices and harvest, value addition.	6
III	Fruit crops: mango, banana, papaya, guava, sapota, citrus, grape, litchi, pineapple, pomegranate, apple, pear, peach, strawberry, nut crops Jackfruit and minor fruits-date, ber, apple, plantation crops-coconut, arecanut, cashew, tea, coffee and rubber.	6
IV	Crop production techniques in palms and plantation crops: Climate and soil requirements, varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity indices, harvest and yield, pests and diseases,	6

	processing- value addition Palms: Coconut, Arecanut, Oil palm and Palmyrah,	
V	Crop production techniques in palms and plantation crops: Climate and soil requirements, varieties, propagation, nursery management, planting and planting systems, cropping systems, after care, training and pruning for plantation crops, water, nutrient and weed management, intercropping, multi-tier cropping system, mulching, special horticultural practices, maturity indices, harvest and yield, pests and diseases, processing- value addition Plantation crops: Tea, Coffee, Cocoa, Cashewnut, Rubber.	6

Reference / Text Books:

1. Banday, F.A. and Sharma, M.K. 2010 Advances in temperate fruit production. Kalyani Publishers, Ludhiana
2. Bose, T.K., S.K. Mitra and D. Sanyal 2001. Fruits: Tropical and Subtropical (2 volumes) Naya Udyog, Calcutta.
3. Bose, T.K., S.K. Mitra, A.A. Farooqi and M.K. Sadhu (Eds). 1999. Tropical Horticulture Vol.1. Naya Prokash, Calcutta.
4. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, Delhi
5. Chadha, T.R. 2001 Textbook of temperate fruits. ICAR, New Delhi
6. Chattopadhyay, T.K. 2001. A Text Book on Pomology (4 volumes). Kalyani Publishers, Ludhiana.
7. Chattopadhyay. 1998. A textbook on pomology (sub-tropical fruits) vol.III. Published by M/s. Kalyani publishers, Ludhiana, New Delhi, Noida. UP.
8. Chudawat, B. S. 1990. Arid fruit culture Oxford & IBH, New Delhi
9. Das, B.C. and Das S.N. Cultivation of minor fruits. Kalyani Publishers, Ludhiana
10. David Jackson and N.E. Laone, 1999. Subtropical and temperate fruit production. CABI publications
11. H.P. Singh and M.M. Mustafa 2009. Banana-new innovations Westville publishing House, New Delhi
12. Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, Tamil Nadu.
13. Mitra, S.K., T.K. Bose and D.S. Rathore. 1991. Temperate fruits. Horticulture and allied Publishers, Calcutta. Pal, J.S. 1997. Fruit Growing. Kalyani Publishers, New Delhi.
14. Radha, T. and Mathew, L. 2007. Fruit crops. New India publishing Agency

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

After the completion of this course the student will be able to learn-

CO1: Importance of vegetables and spices in human nutrition and national economy.

CO2: Production technology of vegetables.

CO3: Production technology of spices.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: IV

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : II
Class: B. Sc. (Hons)Agriculture		Semester IV
Credits: 2 Theory: 2 Practical: 0		Subject: Principles of Agricultural Economics and Farm Management
Course Code: AGR-222		Title: Principles of Agricultural Economics and Farm Management
Course Objectives: To create awareness about broad areas covered under agricultural economics and farm management. To impart knowledge on the efficient and judicious use of resources for optimum agricultural production.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 0 = 2 Credits		
L: 02 T: 00 P: 02 (In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro- and macro-economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.	6
II	Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.	6
III	Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves.	6
IV	Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in	6

	measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programs on population control.	
V	Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning. Forms of business organizations, international trade and balance of payments. GST and its implication on Indian economy.	6
Reference / Text Books:		
1. Johl, S.S. and Kapur, T.R. (2009). <i>Fundamentals of Farm Business Management</i> . Kalyani Publishers.		
2. Reddy, S., Raghu Ram, P., Neelakanta, T.V., & Bhavani Devi, I. (2004). <i>Agricultural Economics</i> . Oxford & IBH Publishing Co. Pvt. Ltd.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal		20
3) Practical/Research Project Report/Seminar On Research Project Report		00
4) ESE		50
Total:		100
Prerequisites for the course:		
Course Learning Outcomes:		
CO1: Understand basic economic concepts and their relevance to agriculture.		
CO2: Analyze demand and supply, cost structures, and production principles in agricultural enterprises.		
CO3: Apply principles of resource allocation and utility in decision-making.		
CO4: Understand the role of agricultural economics in national income, population policies, and farm planning.		
CO5: Recognize implications of economic systems, monetary tools, and GST in Indian agriculture.		

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: IV

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : II
Class: B. Sc. (Hons)Agriculture		Semester IV
Credits: 3		Subject: Agriculture
Theory: 1		
Practical: 2		
Course Code: AGR-223		Title: Crop Production Technology-II (Rabi Crops)
Course Objectives: 1. To impart basic and fundamental knowledge on principles and practices of rabi crop production. 2. To impart knowledge and skill on scientific crop production and management.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 2 = 3 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Theory: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops. Cereals- wheat and barley. Pulses: chickpea, lentil, peas. Rabi redgram and, rajmash	3
II	Sugar crops-sugarcane and sugar beet.	3
III	Oilseed- rapeseed, mustard, sunflower, safflower; and linseed	3
IV	Medicinal and aromatic crops- mentha, lemon grass and citronella. Forage crops – barseem, lucerne and oat; potato, quinoa, tobacco	3
V	Practical: Sowing methods of wheat and sugarcane; identification of weeds in rabi season crops; study of morphological characteristics of rabi crops; study of yield contributing characters of rabi season crops; yield and juice quality analysis of sugarcane; study of important agronomic experiments of rabi crops at experimental farms; study of rabi forage experiments; oil extraction of medicinal crops; visit to research stations of related crops. * Practical Crop Production-One (1) credit from practical of the course is allotted for Practical Crop Production of selected rabi crops covered under this course.	3
Reference / Text Books: 1. B. Gurarajan, R. Balasubramanian and V. Swaminathan. Recent Strategies on Crop Production. Kalyani Publishers, New Delhi. 2. Chidida Singh.1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co.		

Pvt. Ltd., New Delhi.
3. Rajendra Prasad. Textbook of Field Crops Production - Commercial Crops. Volume II ICAR Publication.
4. Rajendra Prasad. Textbook of Field Crops Production - Foodgrain Crops. Volume I ICAR Publication.
5. S.R. Reddy. 2009. Agronomy of Field Crops. Kalyani Publishers, New Delhi.
6. S.S. Singh. 2005. Crop Management. Kalyani Publishers, New Delhi.
7. Rajendra Prasad. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
8. Reddy, S.R. 2004. Agronomy of Field crops, Kalyani Publishers, Ludhiana.
If the course is available as Generic Elective then the students of following departments may opt it. NA

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
• Cereals & Pulses: Analyze and apply production packages for major Rabi cereals (like wheat) and pulses (chickpea, lentil). • Oilseeds & Sugar Crops: Understand the geographical distribution, economic importance, and cultivation practices for Rabi oilseeds (mustard, sunflower) and sugar crops (sugarcane). • Medicinal & Aromatic Crops: Comprehend cultural practices for medicinal (mentha, lemongrass) and aromatic plants. • Forage Crops: Analyze the production packages for important Rabi forage crops (berseem, oat). • Agronomic Practices: Understand soil & climate needs, fertilizer/irrigation requirements, weed management, and yield calculation for Rabi crops. • Practical Skills: Identify Rabi crops, their weeds, apply scientific management, and visit experimental farms for hands-on experience.	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: IV

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: II
Class: B. Sc. (Hons)Agriculture		Semester: IV
Credits: 2		Subject: Agriculture
Theory: 1		
Practical: 1		
Course Code: AGR-224		Title: Farm Machinery and Power
Course Objectives: 1. To enable the students to understand the need of farm power, basic principles and parts of IC engine, different tillage, sowing, intercultural, plant protection equipment, working principles of threshers, harvesting of field and horticultural crops.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Status of Farm Power in India; Sources of Farm Power, I.C. engines, working principles of I C engines; comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and solved problems	3
II	Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply and hydraulic control system of a tractor.	3
III	Familiarization with Power transmission system : clutch; gear box, differential and final drive of a tractor; Tractor types; Cost analysis of tractor power and attached implement; Criteria for selection of tractor and machine implements	3
IV	Familiarization with Primary and Secondary Tillage implement; Implement for hill Agriculture; implement for intercultural operations;	3
V	Familiarization with sowing and planting equipment; calibration of a seed drill and solved examples; Familiarization with Plant Protection equipment; Familiarization with harvesting and threshing equipment.	3
Practical Study of different components of I.C. engine. To study air cleaning and cooling system of engine; Familiarization with clutch, transmission, differential and final drive of a tractor; Familiarization with lubrication and fuel supply system of engine; Familiarization with brake, steering, hydraulic control system of engine; Learning of tractor driving; Familiarization with operation of power tiller; Implements for hill Agriculture; Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow; Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and trans planter; Familiarization with		

different types of sprayers and dusters; Familiarization with different inter-cultivation equipment; Familiarization with harvesting and threshing machinery; Calculation of power requirement for different implements.

Reference / Text Books:

1. Jagdiswar Sahay – Elements of Agricultural Engineering
2. Jain, S.C. and C.R. Rai-Farm Tractor and maintenance and repair. Standard Publishers, 1705-B, Naisarak. Delhi- 110006
3. Ojha, T.P. and A.M. Michael, A.M. Principles of Agricultural Engineering. Vol.I. Jain brothers, 16/893, East Park Road, Karol Bagh, New Delhi -110005
4. Surendra Singh- Farm machinery –Principles and applications, ICAR, New Delhi

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Design various engine components, tractor systems, and power transmission elements.
CO2: Conduct and demonstrate the testing of engines and tractors according to established standards.
CO3: Synthesize and analyze farm machinery and power management systems.
CO4: Understand and apply research and development procedures in farm machinery.
CO5: Apply programming techniques to farm power and machinery management, including maintenance and replacement decisions.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: IV

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: II	
Class: B. Sc. (Hons)Agriculture		Semester: IV	
Credits: 2		Subject: Agriculture	
Theory: 1			
Practical: 1			
Course Code: AGR-225		Title: Water Management	
Course Objectives: 1. To study the important properties of soil affecting water availability to crops and water requirement for optimum growth and development 2. To study different methods of irrigation and water management practices of both field and horticultural crops and drainage. 3. To study the soil moisture conservation practices including management of rain water, watershed and command areas.			
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses			
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits			
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)			
Unit	Contents	No. of Lectures Allotted	
I	Irrigation: definition and objectives; Importance: Function of water for plant growth, water resources and irrigation development for different crops in India	3	
II	Soil plant water relationships; Available and unavailable soil moisture, distribution of soil moisture, water budgeting, rooting characteristics, moisture extraction pattern, effect of moisture stress on crop growth.	3	
III	Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, different approaches of scheduling of irrigation; Methods of irrigation: surface and sub-surface, pressurized methods, viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water;	3	
IV	Layout of different irrigation systems, Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); quality of irrigation water, irrigation management practices for different soils and crops, drip, sprinkler.	3	
V	Layout of underground pipeline system, Irrigation automation, Artificial Intelligence and climate-based irrigation practices and its management.	3	

Practical

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water by using water measuring devices viz., flumes, weirs, notches, orifices; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers' field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; layout for different methods of irrigation, Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Visit to irrigation research centre/ station and visit to command area.

Reference / Text Books:

1. Rao, Y.P. and Bhaskar, S.R. Irrigation technology. Theory and practice. Agrotech publishing Academy, Udaipur.
2. Dilipkumar Mujmdar. Irrigation water management: Principles and Practices. Prentice Hall of India Pvt. Ltd.,
3. S.V. Patil & Rajakumar, G. R., Water Management in Agriculture and Horticultural Crops. Satish serial publishing House, Delhi.
4. Carr M. K. V. and Elias Fereres. Advances in Irrigation Agronomy. Cambridge University Press.
5. Michael, A.M. Irrigation Theory and practice. Vikas publishing house Pvt, Ltd.

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Understand the components of the hydrological cycle and how to estimate streamflow and rainfall variations.

CO2: Grasp the concepts, methods, and terminology for on-farm irrigation and drainage to enhance crop production and soil environments.

CO3: Apply technical concepts and models to analyze water resources, including estimating probable maximum flood and evaluating aquifer parameters.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: IV

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: II
Class: B.Sc (Hons) Agriculture		Semester: IV
Credits: 2		Subject: Agriculture
Theory: 1		
Practical: 1		
Course Code: AGR-226		Title: Problematic Soils and their management
Course Objectives: • To know about the different problematic soils of India. • To gain the knowledge how to identify the problems of soil and water and what are the reclamation method requires improving the soil health. • Students learn practically about the management of problem soil. • Learn different method to improve soil fertility, that necessary to improve the yield.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 1 T:0 P: 1 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (3Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Soil quality and health, Distribution of Waste land and problem soils in India, Categorization of Problem soils based on properties.	3
II	Reclamation and management of Acid soils, Saline, Sodic soils, Acid Sulphate soils, Eroded and Compacted soils, polluted soils.	3
III	Contaminated soils (Pesticide contamination, Heavy metal contamination), Mined soils (Coal mined, Oil mined), Management of Riverine soils, and Water logged soils.	3
IV	Irrigation water – quality and standards, utilization of saline water in agriculture. Use of Remote sensing and GIS in diagnosis and management of problem soils.	3
V	Multipurpose tree (MPT) species, bio remediation through MPTs of soils, land capability and classification, land suitability classification.	3
Reference / Text Books: 1. Maliwal, G.L and SomaniL. L. 2010. Nature and Properties of soil and Management of saline and alkali soils. Agrotech Publishing Academy, Udaipur. 2. Tyagi, N. K. and P.S. Minhas, 1998. Agricultural Salinity Management in India. Published by CSRI Karnal. 3. Das, D. K. Introductory Soil Science. 4. Brady, N.C.2016. The Nature and Properties of Soils.15edn.		

5. Management of Salt affected Soils and Waters-L.L. Somani and K. L. Totawat.	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: - The students get knowledge about different kind of problem soil in India and there characteristics - The students will understand how to control or improve the soil fertility. - The students gain practical knowledge of laboratory to test the problem soil.	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: IV

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : II
Class: B. Sc. (Hons)Agriculture		Semester: IV
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-227		Title: Basics of Plant Breeding
Course Objectives: To acquaint with different techniques ranging from simply selecting plants with desirable characteristics for propagation, to more complex molecular techniques for breeding new varieties, which are higher yielding, resistant to biotic and abiotic stresses for ensuring food security.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male-sterility-genetic consequences, cultivar options,	3
II	Plant genetic resources, its utilization and conservation Domestication, Acclimatization and Introduction Centres of origin/ diversity, Components of Genetic variation. Heritability and genetic advance. Pre-breeding and Universal Plant Breeder’s equation	3
III	Genetic basis and breeding methods in self-pollinated cropsmass and pure line selection, hybridization techniques and handling of segregating population. Multiline concept, Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross-pollinated crops, modes of selection	3
IV	Population movement schemes- Ear to Row method, Modified Ear to Row, recurrent selection schemes. Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties. Breeding methods in asexually propagated crops, clonal selection and hybridization. Wide hybridization and pre-breeding.	3
V	Polyploidy in relation to plant breeding, mutation breeding- methods and uses. Breeding for important biotic and abiotic stresses. Participatory plant breeding. Variety Release and notification. Intellectual Property Rights, Patenting, Plant Breeders and Farmer’s Rights.	3

Practical

Plant Breeder's kit, Study of germplasm of various crops, Study of floral structures of self-pollinated and cross-pollinated crops, Emasculation and hybridization techniques in self and cross pollinated crops, Consequences of inbreeding on genetic structure of resulting populations, Study of male sterility system, Handling of segregating populations, Methods of calculating mean, range, variance, standard deviation, heritability, Designs used in plant breeding experiments, analysis of Randomized Block Design, To work out the mode of pollination in a given crop and extent of natural out-crossing, Prediction of performance of double cross hybrids, Maintenance of breeding records and data collection, Screening tests for biotic and abiotic stresses.

Reference / Text Books:

1. Principles of Plant Breeding (1st & 2nd Edition) by RW Allard.
2. Plant Breeding: Principles & Practices by JR Sharma.
3. Plant Breeding- B.D. Singh.
4. Principles and Procedures of Plant Breeding - Biotechnical and Conventional Approaches by GS Chahal and SS Gosal.
5. Principles of Plant Genetics and Breeding by George Acquaah.

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

Students will know about the genetic basis of self, cross and clonally propagated crops, hybridization techniques and various methods for development of new variety in agricultural and horticulture crops through changing the heredity of plants

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: IV

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: II	
Class: B. Sc. (Hons)Agriculture		Semester: IV	
Credits: 3		Subject: Agriculture	
Theory: 2			
Practical: 1			
Course Code: AGR-228		Title: Agricultural Informatics and Artificial Intelligence (AI)	
Course Objectives:			
1. To acquaint student with the basics of computer applications in Agriculture, multimedia, database management, application of mobile app and decision- making processes, etc.			
2. To provide basic knowledge of computer with applications in Agriculture			
3. To make students familiar with Agricultural-Informatics, its components and applications in Agriculture			
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses			
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits			
L: 02			
T: 00			
P: 02(In Hours/Week)			
Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)			
Unit	Contents		No. of Lectures Allotted
I	Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System: Definition and types, Applications of MS-Office for creating, Editing and Formatting a document, Data presentation, Tabulation and graph creation, Statistical analysis, Mathematical expressions, Database, concepts and types, creating data base, Uses of DBMS in Agriculture. Internet and World Wide Web (WWW): Concepts and components.		3
II	Computer programming: General concepts, Introduction general programming concepts. Concepts and standard input/output operations. e-Agriculture, Concepts, design and development, Application of innovative ways to use information and communication technologies (IT) in Agriculture.		3
III	Computer Models in Agriculture: Statistical, weather analysis and crop simulation models, concepts, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation, IT applications for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management. Smartphone mobile apps in Agriculture for farm advice:		3
IV	Market price, post-harvest management etc. Geospatial technology: Concepts, techniques, components and uses for generating valuable agri-information. Decision support systems: Concepts, components and applications in Agriculture.		3

	Agriculture Expert System, Soil Information Systems etc., for supporting farm decisions. Preparation of contingent crop planning and crop calendars using IT tools. Digital India and schemes to promote digitalization of Agriculture in India.	
V	Introduction to artificial intelligence, background and applications, Turing test. Control strategies, Breadth-first search, Depth-first search, Heuristics search techniques: Best-first search, A* algorithm, IoT and Big Data; Use of AI in Agriculture for autonomous crop management, and health, monitoring livestock health, intelligent pesticide application, yield mapping and predictive analysis, automatic weeding and harvesting, sorting of produce, and other food processing applications; Concepts of smart Agriculture, use of AI in food and nutrition science etc.	3

Practical:

Study of computer components, accessories, practice of important DoS Commands, Introduction of different operating systems such as Windows, Unix/Linux, creating files and folders, File Management .Use of MS-Word and MS Power-point for creating, editing and presenting a scientific documents, MS-EXCEL-Creating a spreadsheet, Use of statistical tools, Writing expressions, Creating graphs, Analysis of scientific data, MS-ACCESS: Creating Database, preparing queries and reports, Demonstration of Agri- information system, Introduction to World Wide Web (WWW) and its components, Introduction of programming languages such as Visual Basic, Java, Fortran, C, C++, Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/ Wofost, Preparation of inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools, Use of smartphones and other devices in agro-advisory and dissemination of market information, Introduction of Geospatial technology, AR/ VR demonstration, Preparation of contingent crop planning, India Digital Ecosystem of Agriculture (IDEA).

Reference / Text Books:

1. Concepts and Techniques of Programming in C by Dhabal Prasad Sethi and Manoranjan, Wiley India.
2. Fundamentals of Computer by V. Rajaroman.
3. Introduction to Information Technology by Pearson.
4. Introduction to Database Management System by C. J. Date.
5. Introductory Agri-Informatics by Mahapatra, Subrat K et al, Jain Brothers Publication.

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Understand the fundamental concepts of computers, operating systems, internet technologies, and IT tools relevant to agriculture.
CO2: Apply data processing tools such as MS-Office, databases, and basic programming concepts to solve agricultural information needs.
CO3: Examine ICT applications, e-Agriculture platforms, crop simulation models, geospatial tools, and DSS for farm-level decision-making.
CO4: Assess the role of AI, IoT, Big Data, and smart devices in precision agriculture, crop/livestock management, and food systems.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: III
Class: B. Sc. (Hons)Agriculture		Semester: V
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-311		Title: Agricultural Marketing and Trade
Course Objectives: 1. To understand the fundamentals of agricultural marketing and trade 2. To analyze the factors influencing supply and demand in agricultural markets 3. To explore different marketing channels and strategies in Agriculture 4. To examine the role of government policies and regulations in agricultural markets		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; Demand, supply and producer’s surplus of agri commodities: nature and determinants of demand and supply of farm products, producer’s surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities.	3
II	Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – meaning, merits and demerits; Marketing process and functions: Marketing process concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labelling (Agmark);	3
III	Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs;	3

IV	Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP and DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation and hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for innovations in agricultural price policy;	3
V	Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; WTO; Agreement on Agriculture (AoA) and its implications on Indian Agriculture; IPR; Role of government in agricultural marketing; Role of APMC and its relevance in the present day context.	3

Practical

Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions –NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning. Application of principles of comparative advantage of international trade.

Reference / Text Books:

1. Acharya, S.S. and Agarwal, N.L. 2006. Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chinna, S.S. 2005. Agricultural Economics and Indian Agriculture. Kalyani Pub, N Delhi.
3. Dominic Salvatore, Micro Economic Theory
4. Kohls Richard, L. and Uhl Josheph, N. 2002. Marketing of Agricultural Products, Prentice-Hall of India Private Ltd., New Delhi.
5. Kotler and Armstrong, 2005. Principles of Marketing, Pearson Prentice-Hall.

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	20
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar On Research Project Report	20
4) ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- Market Fundamentals: Understand basic marketing concepts, functions (grading, standardization, financing), market structures (local to international), and product life cycles.
- Economic Analysis: Apply economic principles to analyze demand, supply, elasticity, price behavior, market arrivals, and producer surplus.
- Trade & Policy: Grasp the importance of trade, understand marketing policies, legislation, and the role of government in market regulation.
- Market Institutions: Learn about the structure and functions of key organizations like APMC

(Mandi), NAFED, FCI, and cooperative marketing systems.

- Risk Management: Identify and analyze risks in agricultural marketing and explore strategies for managing them.
- Technology & Information: Evaluate the application of Information Technology (IT) and market information systems in modern agriculture.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : III
Class: B. Sc. (Hons)Agriculture		Semester V
Credits: 2		Subject: Agriculture
Theory: 1		
Practical: 1		
Course Code: AGR-312		Title: Introduction to Agro-meteorology
Course Objectives: 1. To introduce the students to the concept of weather and climate and underlying physical processes occurring in relation to plant and atmosphere 2. To impart the theoretical and practical knowledge of instruments/equipment used for measurement of different weather variables in an agrometeorological observatory 3. To study the meteorological aspects of climate change in Agriculture and allied activities		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Meaning and scope of agricultural meteorology; Earth atmosphere: its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze;	3
II	Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature,	3
III	Application of Thermal time concept and Crop/Pest weather calendar; Energy balance of earth; Atmospheric humidity, concept of saturation, vapour pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification;	3
IV	Artificial rainmaking. Monsoon- mechanism and importance in Indian Agriculture; Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave; Agriculture and weather relations;	3
V	Modifications of crop microclimate, climatic normal for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.	3

Practical

Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording, Measurement of total, shortwave and long wave radiation, and its estimation using Planck's intensity law, Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS; Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis, Measurement of soil temperature and computation of soil heat flux, Determination of vapor pressure and relative humidity, Determination of dew point temperature, Measurement of atmospheric pressure and analysis of atmospheric conditions, Measurement of wind speed and wind direction, preparation of windrose, Measurement, tabulation and analysis of rain, Measurement of open pan evaporation and evapotranspiration, Computation of PET and AET, Use of synoptic charts, weather reports, weather forecasting-types and methods, crop weather calendar.

Reference / Text Books:

1. Agricultural Meteorology by G.S.L.H.V. Prasado Rao
2. Fundamentals of Agro meteorology and Climate Change by G. S. Mahi and P. K. Kingra
3. Introduction to Agro meteorology and Climate Change by Alok Kumar Patra
4. Introduction to Agro meteorology by H. S. Mavi
5. Text Book of Agricultural Meteorology by M. C. Varshneya and P.B. Pillai

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Introductory knowledge about agro meteorology
CO2: To Understand roles of agro meteorology in agriculture and its relation to other sciences
CO3: To acquaint with recent developments in agro meteorology
CO4: Studies of the characteristics, and atmospheric phenomenon.
CO5: Studies of weather elements and its impact on climate.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : III
Class: B. Sc. (Hons) Agriculture		Semester: V
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-313		Title: Fundamentals of Crop Physiology
Course Objectives: To explain about the basic physiological process of plant viz. plant cell and water relations, mineral nutrition, carbon metabolism, reproductive physiology and plant growth and development		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Definitions of plant physiology and crop physiology; Importance of crop physiology; Relationship of crop physiology with other branches of crop science; Diffusion and osmosis; Physiological roles of water to crop plants; Definition of water potential and components of water potential; Water absorption by plants: Concept of active and passive absorption; Water loss by plants: Types of water loss: transpiration, stomatal physiology and guttation; Water use efficiency; Essential and beneficial elements; Passive and active transport of mineral element; Functions of essential elements; Criteria of essentiality of nutrients; Correction measures for nutrient deficiency symptoms; Foliar nutrition and root feeding – significance; Aeroponics Imbibition; Definitions of plant physiology and crop physiology; Importance of crop physiology; Relationship of crop physiology with other branches of crop science; Diffusion and osmosis; Physiological roles of water to crop plants; Definition of water potential and components of water potential;	3
II	Field capacity, permanent wilting point and available soil moisture; Apoplast, symplast and transmembrane, Ascent of sap – theories and mechanism; Soil-plant-atmospheric continuum. Significance of transpiration. Stomatal opening and closing mechanisms. Definition of Cavitation and embolism. Antitranspirants - types and examples. Hydroponics and sand culture. Overview of plant cell - organelle and their functions. Brief outline of: Photosynthetic apparatus, pigment system, quantum requirement and quantum yield; Structure of chloroplast, Examples of different photosynthetic pigments (chlorophyll, carotenoids, phycobilins etc.), Difference between chlorophyll a and chlorophyll b, Structure of chlorophyll a and chlorophyll b, Short discussion on quantum requirement and	3

	quantum yield, Red drop and Emerson enhancement effect, Pigment system I and II.	
III	Introduction to light reaction of photosynthesis, Light absorption by photosynthetic pigments and transfer of energy. Source of O ₂ during photosynthesis: Hill reaction; Brief introduction to cyclic and non-cyclic photo-phosphorylation: production of assimilatory powers; Introduction to C ₃ , C ₄ and CAM pathways: Calvin Cycle, Hatch and Slack Cycle, CAM Cycle; Significance of these pathways (concept of photorespiration, absence of photorespiration in C ₄ plant: Productivity of C ₄ plant, CAM: an adaptive mechanism); Factors affecting photosynthesis (light, temperature, CO ₂ , O ₂ etc.). Outline of the process of respiration:	3
IV	Definition and importance, Glycolysis, Krebs Cycle and ETC, Factors affecting respiration (O ₂ , temperature, CO ₂ etc.). Terminologies / Definitions: Growth, Development and Differentiation. Measurement of plant growth (fresh weight, dry weight, linear dimension, area etc.). Introduction to CGR, RGR, NAR etc. Photoperiodism: Photoperiodic Classification of plants: Short Day Plant, Long Day Plant, Day Neutral plant etc. Introduction to Photoperiodic induction site of photo-inductive perception, Role of Phytochrome Introduction to Vernalization (What is vernalization, devernalization etc.), Meaning, classification (seasonal, sequential etc), relation with abscission.	3
V	Physiological and biochemical changes during senescence, Abscission and its significance, Concept of stay green, Hormonal regulation of senescence. Terminologies / Definitions: Plant hormone, Plant growth regulators (PGR), Plant growth inhibitor. Recognized classes of PGR (Auxins, Gibberellins, Cytokinins, Ethylene and Absciscic acid) and their major physiological roles, Agricultural uses of PGRs (IBA, NAA, 2, 4 –D, GAs, Kinetin etc).	3

Practical

Study on structure and distribution of stomata; Demonstration of imbibition, osmosis, plasmolysis, estimation of water potential, relative water content; Tissue test for mineral nutrients, identification of nutrient deficiency and toxicity symptoms in plant; Identification of nutrients by hydroponics; Estimation of photosynthetic pigments, rate of photosynthesis, respiration and transpiration; Plant growth analysis; Study on senescence and abscission, hormonal regulation of senescence; Demonstration of the effects of different PGRs on plants, Leaf anatomy of C₃ and C₄ plants

Reference / Text Books:

1. Devlin's Exercises in Plant Physiology by Robert Devlin, Francis H. Witham and David F. Blaydes
2. Fundamentals of Plant Physiology by Lincoln Taiz, Eduardo Zeiger, Ian Max Mølle and Angus Murphy
3. Plant Physiology by Robert M. Devlin and Francis H. Witham
4. Plant Physiology by Lincoln Taiz and Eduardo Zeiger
5. Plant physiology by Frank B. Salisbury and Cleon W. Ross

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20

4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Course offers a foundation for improving the crop production, plant health in view of horticultural crops. Study of plant physiology can help with many elements of horticulture crops and offers solutions, which can practically applicable for students. CO2: Understanding the physiological processes involved in seed germination, seedling development, crop establishment, vegetative growth, flowering, fruit and seed setting, crop maturity, plant hormone interaction, nutrient physiology, stress (biotic/abiotic) physiology, etc., provides a sound scientific foundation for efficient monitoring and advantageous manipulation of these phenomena. CO3: Understanding the physiological processes involved in seed germination, seedling development, crop establishment, vegetative growth, flowering, fruit and seed setting, crop maturity, plant hormone interaction, nutrient physiology, stress (biotic/abiotic) physiology, etc., provides a sound scientific foundation for efficient monitoring and advantageous manipulation of these phenomena	

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : III
Class: B. Sc. (Hons)Agriculture		Semester: V
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-314		Title: Pest management in crops and stored grains
Course Objectives:		
Diagnosis and management of major insect and non- insect pests of crops in field and storage		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits:50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02		
T: 00		
P: 02(In Hours/Week)		
Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	General description on nature and type of damage by different arthropod pests; Scientific name, order, family, host range, distribution, biology and bionomics; Nature of damage and management of major insect pests of various field crops, vegetable crops, fruit crops, plantation crops, ornamental crops, spices and condiments.	3
II	Structural entomology and important household pests, their nature of damage and management. Factors affecting loss of stored grains	3
III	Insect pests, mites, rodents, birds and microorganisms associated with stored grains and their management.	3
IV	Storage structures and methods of grain storage and fundamental principles of stored grains management. Management of non-insect pest of mites, snails and slugs, Concept of IPM, Practices, scope and limitations of IPM	3
V	Classification of insecticides, toxicity of insecticides and formulations of insecticides, Biorational pesticides including insect repellents, antifeedants, Use of drones and AI in pest management,	3
Practical		
Field visit, identification of major insect pests and their damage symptoms. Collection and preservation of major insect pests; collection of damage samples, their identification and herbarium preparation. Methods of monitoring of pest incidence in situ. Management strategies of insect pests of different crops. Study on structural entomology and household pests. Storage structures and methods of grain storage. Spraying techniques for selected field and horticultural crops. Vertebrate pest management, Mass multiplication of NPV and entomopathogenic nematodes.		
Reference / Text Books:		

1. A Textbook of Insect Pest and Disease Management, 2021. Somnath Sen, and Mohd. Sameer, S. Kataria & Sons publish.
2. Agricultural Pests of India and South east Asia, A.S. Athwal, Kalyani Publishers.
3. A Textbook of Applied Entomology, K.P. Srivastava and G. S. Dhaliwal, Kalyani Publish.
4. Essentials of Pest Management: Key Information on Pest Identification and its Management, 2022. Prakash Rambhat Thalya and Ravi Chandra
5. Integrated pest Management Concept and Approaches- G.S. Dhaliwal and Ramesh Arora
6. Pest Management: Methods, Applications and Challenges, Tarique Hassan Askary, Agriculture, Agriculture Issues and policies, Books, Nova, Pest Control, Science and Technology, 2022

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Students will be able to identify the insects, pests.

CO2: Students will be able to identify damage symptoms

CO3: Students will be able to provide basic management strategies to the farming community.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : III
Class: B. Sc. (Hons)Agriculture		Semester: V
Credits: 3		Subject: Agriculture
Theory: 2		
Practical: 1		
Course Code: AGR-315		Title: Diseases of Field and Horticultural Crops and their Management
Course Objectives: 1. To study the symptoms produced on the host 2. To study the etiology of the diseases 3. To know about the disease cycle of the pathogens during pathogenesis 4. To study the epidemiological factors responsible for disease development 5. To study the management techniques for curbing the major diseases of field and horticultural crops		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Symptoms, etiology, disease cycle, epidemiology and management of major diseases of the following field and horticultural crops: Field crops- Rice (blast, brown spot, sheath blight, false smut, bacterial leaf blight, bacterial leaf streak, tungro, khaira); Wheat (rusts, loose smut, Karnal bunt); Maize (banded leaf and sheath blight, southern and northern blight, downy mildew);	3
II	Sorghum (smuts, grain mold, anthracnose); Bajra (downy mildew, ergot) and Finger millet (blast, leaf spot); Groundnut (early and late leaf spots, rust, wilt); Soybean (rhizoctonia blight, bacterial spot, seed and seedling rot, mosaic); Grams (Ascochyta blight, wilt, grey mold); Pea (downy mildew, powdery mildew, rust); Black gram and Green gram (web blight, Cercospora leaf spot, anthracnose, yellow mosaic); Sugarcane (red rot, smut, grassy shoot, ratoon stunting, Pokah Boeng);	3
III	Mustard (Alternaria blight, white rust, downy mildew, sclerotinia stem rot) and Sunflower (sclerotinia stem rot, Alternaria blight); Cotton (anthracnose, vascular wilts, black arm). Horticultural crops: Citrus (canker, gummosis) and Guava (wilt, anthracnose); Banana (sigatoka, Panama wilt, bacterial wilt, bunchy top); Papaya (foot rot, leaf curl, mosaic) and Pomegranate (bacterial blight);	3
IV	Apple (scab, powdery mildew, fire blight, crown gall) and Peach (leaf curl); Grapevine (downy mildew, powdery mildew, anthracnose) and Strawberry (leaf spot); Coconut (bud rot, Ganoderma wilt), Tea (blister blight) and Coffee (rust);	3

	Mango (anthracnose, malformation, bacterial blight, powdery mildew); Potato (early and late blight, black scurf, leaf roll, mosaic) and Tomato (damping off, wilt, early and late blight, leaf curl, mosaic);	
V	Brinjal (phomopsis blight and fruit rot, sclerotinia blight) and Chilli (anthracnose and fruit rot, wilt, leaf curl); Cucurbits (powdery and downy mildew, wilts) and Cruciferous vegetables (Alternaria leaf spot, black rot, cauliflower mosaic); Beans (anthracnose, bacterial blight) and Okra (yellow vein mosaic); Ginger (soft rot), Turmeric (leaf Spot) and Coriander (stem gall); Rose (dieback, powdery mildew, black leaf spot) and Marigold (botrytis blight, leaf spots).	3
	Practical To study the symptoms of different diseases of field and horticultural crops: Blast and brown spot of rice, sheath blight and bacterial leaf blight of rice, downy mildew and powdery of cucurbits, rhizoctonia and Cercospora leaf spot of green gram / black gram, Alternaria blight and downy mildew of mustard, early blight of late blight of potato and tomato, Phomopsis blight of brinjal, powdery mildew and rust of pea, stem gall of coriander, anthracnose and fruit rot of chilli, taphrina leaf spot of turmeric, red rot of sugarcane, acquaintance with fungicides, antibiotics and biopesticides and their use in management of diseases of horticultural crops. Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems, Collection and preservation of plant diseased specimens for herbarium.	
Reference / Text Books: 1. Integrated Plant Disease Management By R.C. Sharma 2. Plant Diseases By R.S. Singh 3. Plant Disease Management: Principles and Practices By Hriday Chaube 4. Plant Pathology By G.N. Agrios		
If the course is available as Generic Elective then the students of following departments may opt it.		
NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40
Total:		100
Prerequisites for the course:		
Course Learning Outcomes:		
CO 1: Students will get acquainted with the identification of the causal agents, symptoms, etiology, disease cycle		
CO2: Students will study about the major diseases of field crops like rice, maize, sorghum, bajra, pigeonpea, sesame etc. and Horticultural crops like guava, banana, brinjal, black & green gram, beans, tomato etc.		

IIMTU-NEP IMPLEMENTATION+9

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : III
Class: B. Sc. (Hons)Agriculture		Semester: V
Credits: 2	Subject: Agriculture	
Theory: 1		
Practical: 1		
Course Code: AGR-316		Title: Crop Improvement (kharif crops) – I
Course Objectives: 1. To provide knowledge about Self-pollinated and cross pollinated Kharif crops 2. To learn about origin and distribution of Kharif crops 3. To design breeding objectives of major kharif crops 4. To impart information on different crop varieties for Kharif season		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02		
T: 00		
P: 02(In Hours/Week)		
Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops of kharif season;	3
II	Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters;	3
III	Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops.	3
IV	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional);	3
V	Hybrid seed production technology in maize, rice, sorghum, pearl millet and pigeonpea etc. Ideotype concept, climate resilient crop varieties for future.	3
Practical Botany of crops, Floral biology, emasculation and hybridization techniques in different crop species, viz. rice, jute, maize, sorghum, pearl millet, ragi, pigeonpea, urdbean, mungbean, soybean, groundnut, sesame, castor, cotton, cowpea, tobacco, brinjal, okra and cucurbitaceous crops. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seed production in kharif crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different		

characters; Visit to seed production plots; Visit to AICRP breeding plots of different crops.

Reference / Text Books:

1. Breeding field crops -I by V.L. Chopra
2. Genetic improvement of field crops by C.B. Singh and D. Khare
3. Genetics and Breeding of Pulse crops by D.P. Singh
4. Vegetable breeding – Principles and Practices by Hari Har Ram
5. Breeding field crops by D.A. Sleper and J.M. Poehlman
6. Plant Breeding –theory and practice by S.K. Gupta
7. Breeding Asian field crops by J.M. Poehlman and D.N. Barthakur
8. Practical manuals on Crop Improvement I (Kharif crops) by Rajendra Kumar Yadav

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: The students will be able to know about important botanical status and reproductive structures of crops, different breeding objectives, breeding strategies and genetics of important kharif crops.
CO2: Understand and apply classical (pedigree, bulk, backcross) and modern breeding techniques for self-pollinated and cross-pollinated crops.
CO3: Grasp concepts of heterosis, inbreeding depression, and field techniques for hybrid seed production.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year : III
Class: B. Sc. (Hons)Agriculture		Semester: V
Credits: 2		Subject: Agriculture
Theory: 1		
Practical: 1		
Course Code: AGR-317		Title: Weed Management
Course Objectives:		
1. To teach students about principles of weed science		
2. To impart practical knowledge of weed management in field and horticultural crops		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 0 = 2 Credits		
L: 02		
T: 00		
P: 02(In Hours/Week)		
Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to weeds, characteristics of weeds, their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds, crop-weed completion, factors of competition, factors affecting growth and development.	3
II	Studies on weed seed bank, weed shifts. Concepts of weed management: physical, cultural, chemical and biological; principles and methods, integrated weed management	3
III	Implements for weed control, robotic weed control, weed management in organic/natural farming. Herbicide classification and properties of important herbicides, concept of adjuvants, surfactants, herbicide formulation and their use,	3
IV	Nano herbicides, precision weed management; Mode of action of herbicides and selectivity phenomenon. Concept of herbicide mixture and utility in Agriculture, Herbicide compatibility with agro-chemicals and their application,	3
V	Herbicide resistance and its management. Weed management in different field and horticultural crops; aquatic weed management, weed management in cropping systems.	3
Practical		
Techniques of weed preservation, weed identification and losses caused by weeds. Biology of important weeds. Study weeds in different situations, Study of herbicide formulations and mixture of herbicide. Study methods of herbicide application, Herbicide application equipment their parts, use, maintenance and calibration. Weed control implements, Calculation of herbicide doses and requirement, weed control efficiency and weed index, Phytotoxicity of herbicides, Weed management in fallow lands, Management of problem and parasitic weeds.		

Reference / Text Books:

1. Crafts, A.S. and Robbins, W.W. 1973. Weed Control. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
2. Gupta, O.P. 1984. Scientific Weed Management. Today and Tomorrow Printers and Publishers, New Delhi.
3. Gupta, O.P. 2015. Modern Weed Management. Agro Bios (India), Jodhpur.
4. Naidu, V.S.G.R. Handbook of Weed Identification. Directorate of Weed Research, Jabalpur.
5. Rajagopal, A., Aravindan, R. and Shanmugavelu, K.G. 2015. Weed management of Horticultural Crops. Agrobios (India), Jodhpur.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: To understand weed and crop
CO2: Knowledge on weeds persistence and competitiveness with crops
CO3: To acquaint with weed management principles and practices for sustainable agriculture
CO4: Experience on the knowledge of herbicides, their resistance, toxicity and residue management under different cropping systems.
CO5: knowledge on herbicide calculation and preparation of stock solution

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: III
Class: B. Sc. (Hons)Agriculture		Semester V
Credits: 2		Subject: Agriculture
Theory: 1		
Practical: 1		
Course Code: AGR-318		Title: Ornamental Crops, MAPs and Landscaping
Course Objectives: 1. To educate in detail about origin, area, climate, soil, improved varieties production technology of flowers and MAPs 2. To educate about concept, designing principles and components of landscaping 3. To educate about the physiological disorders of commercial flowers 4. To educate about the post-harvest management and value addition in flower crops and MAP		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Production technology of ashwagandha, costus, isabgol and geranium; Production technology of mint, aloe and ocimum, Coleus, Glory lily, Periwinkle etc.; Production technology of plants like lemongrass, citronella, vetiver and palmarosa etc.,	3
II	Importance and scope of ornamental crops; Importance and scope of medicinal and aromatic plants and landscaping; Principles of landscaping; Landscape uses of trees, shrubs and climbers	3
III	Production technology of important cut flowers like rose, gerbera and orchids; Production technology of gladiolus, tuberose and lilium; Production technology of chrysanthemum and carnation;	3
IV	Package of practices for loose flowers like marigold and jasmine under open conditions; Brief concept of Home landscaping	3
V	Carpet bedding, Topiary, Bonsai, Lawn, flower arrangement, Herbaceous Border, Hedge, Edge etc.; Processing and value addition imp ornamental crops; Processing and value addition of MAPs produce.	3
Practical Identification MAPs and Ornamental plants (trees, shrubs, climbers, seasonal flower and house plants). Propagation of MAP, Bed preparation and planting of MAP; Nursery bed preparation and sowing of seasonal flower seeds; Propagation of ornamental plants by terminal/herbaceous cuttings; Propagation of Anthurium and orchids; Propagation of bougainvillea; Planting of gerbera suckers;		

Gladiolus corms; Establishment and maintenance of lawn; Preparation of flower preservatives and their use in extending the vase life of cut flowers; Training and pruning of ornamental plants and raising of hedge and edge; Planning and layout of garden.

Reference / Text Books:

1. Floriculture in India by G.S. Randhawa and Mukopadhyay
2. Introduction to spices, plantation crops, medicinal and aromatic plants by N. Kumar, Abdul Khadder, P. Rangaswamy, I. Irulappam
3. Textbook of floriculture and landscaping by Anil K. Singh and Anjana Sisodia

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Ability to identify Ornamental, medicinal and aromatic plants.
CO2: A thorough understanding of production and intercultural operations in Ornamental, medicinal and aromatic plants.
CO3: Proper understanding of post-harvest management and marketing of Ornamental, medicinal and aromatic plants.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: III
Class: B. Sc. (Hons)Agriculture		Semester: V
Credits: 2	Subject: Agriculture	
Theory: 1		
Practical: 1		
Course Code: AGR-319		Title: Introductory Agro forestry
Course Objectives: 1. To study Agro forestry as an alternate system of land use 2. To study different types of Agro forestry for soil and water conservation. 3. To study the characteristics of Agro forestry in terms its potential for soil moisture conservation practices		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Agro-forestry: Definition and scope of Agroforestry system, Type of Agroforestry system, potential of Agroforestry in India, Prevailing agroforestry system in India; MPTS- definition, role of MPTS in agroforestry system, its selection for different agroforestry system, MPTS of India	3
II	Ecological aspects of Agroforestry system, tree -crop interaction – competition, nutrient recycling; Traditional Agroforestry as a viable choice to conserve Agro biodiversity of India. Management of Agro-forestry system;	3
III	Role of agroforestry in soil and water conservation; windbreak; Shelterbelt–definition, objectives.; Socio- economic aspects of Agroforestry system; Design and Diagnostic study of agroforetry system; Silviculture: Definition and scope, Propagation of tree species, Regeneration by seed, coppice, root suckers,	3
IV	Transplanting, stump, branch cutting, rhizomes; Nursery bed preparation and management; Cultural practices for bare root and seedling, field handling of nursery stock; Management of tree species; Silviculture of important tree species, choice of species- site factors, root, crown and bole characteristics, phenology, nutritional and water requirement, ground operation, tending, harvesting utility etc	3
V	Horticulture and forage crops-based agroforestry models developed by ICAR-IGFRI; Agroforestry models developed by Indian council of Forestry Research and Education.	3

Practical

Identification of tree species in agro-forestry, Study of tree growth measurement, Study of environmental parameters affecting AF System, Plant propagation methods, Pre-sowing seed treatment, Preparation of nursery bed exercise, practicing propagation techniques for trees, Afforestation method, practical training, pruning, coppicing, pollarding etc. Planting pattern and designs for plantation, natural and artificial regeneration, Design and diagnostic survey of agroforestry system, Evaluation of agro-forestry system in different agro climatic zones, Exposure Visit to prevailing agroforestry systems of the state and related important institutions, Virtual visit of agroforestry models developed by ICAR-IGFRI, ICFRE.

Reference / Text Books:

1. Nair, P.K. R. 1993. An Introduction to Agroforestry, Kluar Academic Publisher
2. Chundawat D. S. and S.K. Gautham. 2017. Textbook of Agroforestry. Oxford & IBH Publishing, (ISBN: 9788120408326)
3. Parthiban, K. T, N. Krishnakumar and M. Karthick. 2018. Introduction to Forestry, Scientific Publisher, Jodhpur. 350p
4. Divya M. P. and K. T. Parthiban. 2005. A Textbook on Social Forestry and Agroforestry. Satish Serial Publishing, New Delhi (ISBN: 9384988952).

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Ability to identify Ornamental, medicinal and aromatic plants.
CO2: A thorough understanding of production and intercultural operations in Ornamental, medicinal and aromatic plants.
CO3: Proper understanding of post-harvest management and marketing of Ornamental, medicinal and aromatic plants.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: V

Programme: Certificate/Diploma/Degree/ UG(R) /PG/Ph.D.		Year: III
Class: B. Sc. (Hons) Agriculture		Semester: V
Credits: 2 Theory: 1 Practical: 1		Subject: Agriculture
Course Code: AGR-320		Title: Sheep and Goat Production
Course Objectives: To educate the students on advances in sheep and goat farming for improving their productivity through different management practices.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Role of sheep and goat husbandry in dry farming in India, Present development programmes in sheep and goat production, needs and possibilities for future research.	3
II	Advances in feeding management, Nutrient deficiencies in range forage, Feed to supplement range forage, General feeding practices, Feeding materials, Lamb feeding, Use of antibiotics and hormones, Hand feeding, Self-feeding, Pellet feeding, Feeding lambs and ewes during lactation.	3
III	Advances in reproduction, selection of Breeding stock, Breeding problems	3
IV	Housing management for goat and sheep, Shearing methods and culling of sheep and goat, Marketing systems and government schemes.	3
V	Common diseases of sheep and goats, Disease prevention and control strategies Parasitic control and its relevance to current environmental changes. Products and their evaluation (e.g., chevon, milk, fiber) Economics of sheep and goat farming, including farm budgeting and project formulation,	3
Reference / Text Books:		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20

3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Demonstrate knowledge of animal health and disease control	
CO2: Apply knowledge of modern animal production technologies, sustainable production systems and animal products	
CO3: Interpret and critically evaluate scientific information as it applies to the field of Animal Science.	

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/Degree / UG(R) /PG/Ph.D.		Year: III
Class: B. Sc. (Hons)Agriculture		Semester: VI
Credits: 3 Theory: 2 Practical: 1		Subject: Agriculture
Course Code: AGR-321		Title: Fundamentals of Agricultural Biotechnology
Course Objectives: To familiarize the students with the fundamental principles of biotechnology, various developments in biotechnology and its potential applications.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to Plant Tissue Culture and Genetic Engineering: History; Cellular tot potency and cytodifferentiation; Callus culture, Single-cell/suspension culture and their applications; Organogenesis and somatic embryogenesis; Somaclonal variation and its use in crop improvement; Embryo rescue technique and its significance in hybrid development	3
II	In vitro fertilization, ovule culture and its significance in hybrid development; Protoplast isolation, culture and regeneration; Somatic hybridization (somatic hybrids and cybrids) and its application in crop improvement; Anther and pollen culture for haploid production; Development of disease-free (virus free) plants through apical meristem culture	3
III	Micropropagation technique for the generation of quality planting material; Synthetic seeds and its applications; National certification and Quality management of TC plants-secondary metabolite production- in vitro germplasm conservation	3
IV	Introduction to Molecular Biology: DNA structure, structure and function; DNA replication, transcription and translation, RNA, types and function; Structure of prokaryotic and eukaryotic gene; Central dogma of life - DNA replication, transcription, genetic codestranslation and protein synthesis; Lac Operon concept - Nucleic acid hybridization; Polymerase chain reaction- DNA sequencing – Sanger method; PCR and its applications.	3

V	Introduction to recombinant DNA technology: DNA modifying enzymes and vectors; plant genetic transformation – physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods; Transgenic and its importance in crop improvement with successful stories; biosafety. Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.; Marker-assisted breeding in crop improvement	3
Practical Introduction to Plant Tissue Culture Laboratory; Good Laboratory Practices; Media Preparation and sterilization; Glassware sterilization; Micropropagation; Callus induction and culture; Anther culture; Apical meristem culture; Preparation of synthetic seeds; Isolation of plasmid DNA; Quantification of DNA; Agarose Gel Electrophoresis and visualization of plasmid DNA; Restriction digestion of plasmid DNA and agarose gel electrophoresis; Isolation of Plant genomic DNA; PCR amplification of DNA; Gel electrophoresis of amplified DNA; Visit to tissue culture units /biotech labs.		
Reference / Text Books: 1. Bhojwani SS. 1983. Plant Tissue Culture: Theory and Practice. Elsevier. 2. Singh BD. 2007. Biotechnology: Expanding Horizon. Kalyani 3. Christou P and Klee H. 2004. Handbook of Plant Biotechnology. John Wiley & Sons. 4. Lewin B. 2008. Gene IX. Peterson Publications/ Panima. W.H. Freeman & Co. 5. Primrose SB. 2001. Molecular Biotechnology. Panima.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40
Total:		100
Prerequisites for the course:		
Course Learning Outcomes:		
CO1: Plant & Animal Systems: Grasping molecular processes in growth, development, and the application of techniques like tissue culture for crop improvement and genetic base widening. CO2: Genetic Engineering: Understanding transgenic approaches, DNA markers, and creating GMOs for enhanced traits (yield, pest resistance). CO3: Microbial Applications: Recognizing the role of microorganisms in biofertilizers, biocontrol, and industrial production. CO4: Agro-Biotech Industry: Learning about bio-products, their production steps, and applications in modern agriculture.		

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/ Degree/ UG(R) /PG/Ph.D. Class: B. Sc. (Hons)Agriculture		Year : III
Credits: 3 Theory: 2 Practical: 1		Semester: VI
Course Code: AGR-322		Subject: Agriculture
Course Objectives: 1 To provide an idea on statistical concepts of both descriptive and inference Statistics which will be useful to do statistical analysis		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to Statistics and its Applications in Agriculture. Types of Data. Scales of measurements of Data. Summarization of Data. Classification of Data. Frequency Distribution. Methods of Classification. Definition of Grouped and Ungrouped Data. Definition of Class Interval (formula for determining the no. of class interval), Width of CI, Class Limits (Boundaries), Mid Points. Types of Frequency Distribution. Diagrammatic Presentation of Data. Bar Diagrams – Simple, Multiple, Sub-divided and Percentage Bar Diagrams. Pie-diagram. Graphical Presentation of Data – Histogram, Frequency Polygon and Ogives.	3
II	Measures of Central Tendency. Requisites for an Ideal Measure of Central Tendency. Different Types of Measure. Arithmetic Mean– Definition, Properties, Merits, Demerits and Uses. A.M. (examples) for Grouped and Ungrouped Data. Step-deviation Method. Weighted Mean. Definition of Geometric Mean and Harmonic Mean. Relationship between A.M., G.M. and H.M. Median- Definition, Merits, Demerits and Uses. Graphical Location of Median. Mode- Definition, Merits, Demerits and Uses. Graphical Location of Mode. Relationship between Mean, Median and Mode	3
III	Measures of Dispersion. Characteristics for an Ideal Measure of Dispersion. Different Types of Measures of Dispersions. Definition of Range, Interquartile Range, Quartile Deviation and Mean Deviation. Standard Deviation- Definition, Properties. S.D. and Variance for Grouped and Ungrouped Data. Variance of Combined Series. Co-efficients of Dispersions. Co-efficient of Variation. Measures of Skewness and Kurtosis. Definition of Symmetrical Distribution. Definition of Skewness	3

IV	Measures of Skewness. Definition of Kurtosis. Measure of Kurtosis. Relationship between Mean, Median and Mode for Symmetrical and Skewed Distribution. Probability Theory and Normal Distribution. Introduction to Probability. Basic Terminologies. Classical Probability-Definition and Limitations. Empirical Probability- Definition and Limitations. Axiomatic Probability. Addition and Multiplication Theorem (without proof). Conditional Probability. Independent Events. Simple Problems based on Probability. Definition of Random Variable. Discrete and Continuous Random Variable. Normal Distribution-Definition, Prob. Distribution, Mean and Variance. Assumptions of Normal Distribution. Normal Probability Curve. Correlation and Regression	3
V	Definition of Correlation. Scatter Diagram. Karl Pearson's Coefficient of Correlation. Types of Correlation Coefficient. Properties of Correlation Coefficient. Definition of Linear Regression. Regression Equations. Regression Coefficients. Properties of Regression Coefficients. Tests of Significance. Definition. Null and Alternative Hypothesis. Type I and Type II Error. Critical Region and Level of Significance. One Tailed and Two Tailed Tests. Test Statistic. One Sample, Two Sample and Paired t-test with Examples. F-test for Variance. ANOVA and Experimental Designs. Definition of ANOVA. Assignable and Non assignable Factors. Analysis of One-way Classified Data. Basic Examples of Experimental Designs. Terminologies. Completely Randomized Design (CRD). Sampling Theory. Introduction. Definition of Population, Sample, Parameter and Statistic. Sampling Vs Complete Enumeration. Sampling Methods. Simple Random Sampling with Replacement and without Replacement. Use of Random Number Table.	3

Practical

Diagrammatic and Graphical representation of data. Calculation of A.M., Median and Mode (Ungrouped and Grouped data). Calculation of S.D. and C.V. (Ungrouped and Grouped data). Correlation and Regression analysis. Application of t-test (one sample, two sample independent and dependent). Analysis of variance one-way classification. CRD. Selection of random sample using simple random sampling.

Reference / Text Books:

1. Fundamentals of Statistics by D. N. Elhance, Kitab Mahal Publishers.
2. Fundamentals of Applied Statistics by S.C. Gupta and V. K. Kapoor, Sultan Chand and Sons.
3. Basic Statistics by B. L. Agarwal, New Age International Publishers.
4. Agricultural Statistics by S.P. Singh and R.P.S. Verma, Rama Publishing House.
5. Agriculture and Applied Statistics-I by P.K. Sahu, Kalyani Publishers.
6. Agriculture and Applied Statistics-II by P. K. Sahu and A. K. Das, Kalyani Publishers.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Data Handling: Summarize, classify, tabulate, and graphically represent agricultural data (e.g., box plots, charts).

CO2: Probability & Distributions: Understand probability theory and apply common distributions (Binomial, Poisson, Normal) to agricultural scenarios.

CO3: Sampling & Inference: Grasp sampling techniques, estimate parameters, and test hypotheses for drawing conclusions about populations (like crop yields).

CO4: Experimental Design: Learn principles of field experimentation (e.g., Randomized Block Design) and design questionnaires.

CO5: Regression & Correlation: Analyze relationships between variables (e.g., fertilizer use and yield) using simple/multiple regression and correlation.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/ Degree/ UG(R) /PG/Ph.D. Class: B. Sc. (Hons)Agriculture		Year: III Semester: VI	
Credits: 2 Theory: 1 Practical: 1		Subject: Agriculture	
Course Code: AGR-323		Title: Crop Improvement (Rabi crops)-II	
Course Objectives: 1. To provide knowledge about self-pollinated and cross-pollinated rabi crops 2. To learn about origin and distribution of rabi crops 3. To design breeding objectives of major rabi crops 4. To impart information on different crop varieties for rabi season			
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses			
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits			
L: 01 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)			
Unit	Contents	No. of Lectures Allotted	
I	Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and other horticultural crops	3	
II	Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters	3	
III	Important concepts of breeding self-pollinated, cross-pollinated and vegetatively propagated crops.	3	
IV	Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional);	3	
V	Hybrid seed production technology in wheat, oat, chickpea, rapeseed and mustard etc. Ideotype concept, climate resilient crop varieties for future.	3	
Practical Botany of crops, Floral biology, emasculation and hybridization techniques in different crop species, viz. wheat, oat, rapeseed and mustard, pulses, potato, sugarcane, tomato, chilli, onion etc. Study of field techniques for seed production and hybrid seed production in rabi crops; Estimation of heterosis, inbreeding depression and heritability; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP breeding plots of different crops.			
Reference / Text Books: 1. Breeding Field Crops -I by V.L. Chopra			

2. Genetic Improvement of Field Crops by C.B. Singh and D. Khare 3. Genetics and Breeding of Pulse crops by D.P. Singh 4. Vegetable Breeding – Principles and Practices by Hari Har Ram 5. Breeding Field Crops by D.A. Sleper and J.M. Poehlman 6. Plant Breeding –Theory and practice by S.K. Gupta 7. Breeding Asian field Crops by J.M. Poehlman and D.N. Barthakur 8. Practical Manuals on Crop Improvement I (Rabi crops) by Rajendra Kumar Yadav	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Understanding Plant Genetics & Resources: Explain genetics of qualitative/quantitative traits, identify crop origins, wild relatives, and manage plant genetic resources (PGR).	
CO2: Breeding Principles: Compare conventional (hybridization, selection) and modern (biotech) approaches for developing improved varieties/hybrids.	
CO3: Breeding Objectives: Develop crops with higher yield, better quality (nutritional, physical), adaptability, stability, and resistance to biotic (pests/diseases) and abiotic (drought, heat) stresses.	
CO4: Ideotype Concept: Apply the Ideotype concept to design and develop ideal crop plants for specific environments.	
CO5: Seed Technology: Apply field techniques for hybrid seed production and understand seed production in self, cross-pollinated, and vegetative propagated crops.	

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/ Degree/ UG(R) /PG/Ph.D. Class: B. Sc. (Hons)Agriculture		Year: III Semester: VI	
Credits: 2 Theory: 1 Practical: 1		Subject: Agriculture	
Course Code: AGR-324		Title: Renewable energy in Agriculture and Allied Sector	
Course Objectives: 1. To gain the knowledge on different types of materials used in Renewable Energy 2. To understand the importance of Renewable Energy technology and its applications 3. To train the students on the applications of solar thermal technology			
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses			
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits			
L: 01 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)			
Unit	Contents	No. of Lectures Allotted	
I	Classification of energy sources, contribution of these of sources in agricultural sector; Familiarization with biomass utilization for biofuel production and their application;	3	
II	Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource	3	
III	Introduction of solar energy, collection and their application; Familiarization with solar energy gadgets: solar cooker,	3	
IV	solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application	3	
V	Introduction of wind energy and their application. Availability of bio mass and their application in different places.	3	
Practical Familiarization with renewable energy gadgets. To study biogas plants, gasifier, production process of biodiesel, briquetting machine, production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing, solar cooker and solar drying system. To study solar distillation, solar pond and solar wind hybrid system. Field visit to Solar –Wind farm.			
Reference / Text Books: 1. C.S. Solanki. 2011. Solar Photovoltaic – Fundamentals, Technologies and Applications. PHI			

Learning Pvt. Ltd.	
2. S. Sukhatme and J. Nayak. 2008. Solar Energy: Principles of Thermal Collection and Storage. Third Edition (Tata McGraw-Hill).	
3. V.V.N. Kishore. 2008. Renewable Energy Engineering and Technology: Principles and Practice, Teri, India	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Energy Fundamentals: Understand diverse renewable energy sources (solar, biomass, wind) and their specific contributions to agriculture and allied sectors.	
CO2: Solar Energy Applications: Grasp concepts and practical applications of solar energy, including photovoltaic systems, solar thermal devices (dryers, pumps), and their benefits for crop processing and irrigation.	
CO3: Bioenergy & Biofuels: Learn about biogas, biodiesel, and bio-alcohol production from agricultural waste, and develop skills in designing low-cost biogas reactors for farm waste management.	
CO4: Wind Energy: Understand wind energy principles and their practical use in agricultural settings, possibly including small-scale wind turbines.	
CO5: Green Technology Integration: Exercise the functioning and utilization of these technologies to promote overall green technology and sustainable practices in farming.	

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/ Degree/ UG(R) /PG/Ph.D. Class: B. Sc. (Hons)Agriculture		Year: III
Credits: 2 Theory: 1 Practical: 1		Semester: VI
Course Code: AGR-325		Subject: Agriculture
Title: Dryland Agriculture/ Rainfed Agriculture and watershed management		
Course Objectives: 1. To learn about characteristics and conditions of dryland/rainfed Agriculture 2. To gain knowledge about drought and its mitigation 3. To impart knowledge on water harvesting and watershed management		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 01 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Dryland/Rainfed Agriculture: Introduction, types and characteristics; History of dry land/ rainfed Agriculture in India; Problems and prospects of dry land/rainfed Agriculture in India; Soil and climatic conditions prevalent in dry land/rainfed areas	3
II	Length of Growing Period (LGP) and Soil Moisture Availability (SMA) and its impact on crop and cropping system; Soil and water conservation techniques; Drought: types, effect of water deficit on physio- morphological characteristics of the plants;	3
III	Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices; Crops and cropping systems in dry land/rainfed areas; Management of crops in dry land/rainfed areas;	3
IV	Contingent crop planning for aberrant weather conditions; Concept, history, objective, principles and components of watershed management, factors affecting watershed management. Log term rainfall analysis in relation to simple mathematical models and forecasting the weather abnormalities	3
V	Alternate land use system location; regional and crop specific dryland principles and practices for profitable and sustainable dryland farming and allied enterprises.	3
Practical Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern		

of onset and withdrawal of monsoons. Calculation of Length of Growing Period (LGP) and Soil Moisture Availability (SMA) Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country. Effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress including mechanical and agronomic measure. Soil moisture determination under different land situations, Importance of seed priming to mitigate drought. Assessment of meteorological drought. Characterization and delineation of model watershed. Seed treatment, viz., seed hardening and seed priming techniques for all the agricultural crops Field demonstration on soil and moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed

Reference / Text Books:

1. A.K. Srivastava and P.K. Tyagi. 2011. Practical Agricultural Meteorology. New Delhi Publishing Agency, New Delhi.
2. D. Lenka. 2006. Climate, Weather and Crops in India. Kalyani Publishers, New Delhi.
3. G.S.L.H.V. Prasad Rao. 2008. Agricultural Meteorology. Prentice Hall of India Pvt. Ltd., New Delhi.
4. H.S. Mavi and Graeme J. Tupper. 2005. Agrometeorology – Principles and applications of climate studies in Agriculture. International Book Publishing Co., Lucknow.
5. H.S. Mavi. 1994. Introduction to Agrometeorology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Understand Soil plant water relationships
CO2: Identify Methods of soil moisture estimation
CO3: Identify effective rainfall, scheduling of irrigation
CO4: Study Irrigation efficiency and water use efficiency

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/ Degree/ UG(R) /PG/Ph.D. Class: B. Sc. (Hons)Agriculture		Year: III	
Credits: 2 Theory: 1 Practical: 1		Semester: VI	
Course Code: AGR-326		Subject: Agriculture	
Course Objectives: 1. To get an introduction to microbiology with specific focus on its significance in Agriculture science. 2. To get acquainted with the bacterial structure and the function of the different bacterial components. 3. To get highlights on different fields of microbiology. 4. To get highlights on the bioremediation of polluted soils using microbial mediators and phytoremediation. 5. To get a concept of biological control and the role of biopesticides in plant disease management.		Title: Agricultural Microbiology and Phyto-remediation	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses			
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits			
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)			
Unit	Contents	No. of Lectures Allotted	
I	Introduction to Microbiology: Definition, applied areas of Microbiology and Importance of Microbiology. History of Microbiology: Discovery of microorganisms, spontaneous generation theory, Germ theory of diseases, Immunization, fermentation, and origin of life. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.	3	
II	Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, genetic engineering. Soil Microbiology: Nutrient mineralization and transformation, Air Microbiology: Phyllosphere microflora, Phylloplane microflora, microflora of floral parts etc. Food Microbiology: Microbial spoilage and principles of food preservations	3	
III	Food poisoning. Water Microbiology: Types of water, water microorganisms, and microbial analysis of water e.g. coliform test, Purification of water. Industrial Microbiology: Microbial products, Biodegradation, Biogas production, Biodegradable plastics etc	3	

IV	Biological control: Microbial biopesticides for plant disease management Concepts of rhizosphere microbiology-Rhizodeposits-biochemical nature, release mechanism in rhizosphere, function, Carbon flow in rhizosphere,	3
V	Rhizosphere micro biomeresidents and their roles. Potential of plant growth promoting rhizobacteria (PGPR) and endophytes on soil health and sustainability. Bioremediation of polluted soils using microbial mediators. Phytoremediation of polluted soils.	3

Practical

Study of the microscope; Acquaintance with laboratory material and equipment; Microscopic observation of different groups of microorganisms: moulds (Fungi); Direct staining of bacteria by crystal violet; Negative or indirect staining of bacteria by nigrosin; Gram staining of bacteria; Study of phyllosphere and rhizosphere microflora; Measurement of microorganisms; Preparation of culture media; Isolation and purification of rhizospheric microbes; Isolation and purification of N-fixers; Isolation and purification of Nutrient solubilizers; Isolation and purification of Endophytes.

Reference / Text Books:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. 2002. Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
2. Rangaswami, G. and Bagyaraj, D. J. 2005. Agricultural Microbiology. Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Mukherjee, N. and Ghosh, T. 2004. Agricultural Microbiology. Kalyani Publishers, Calcutta
4. Dubey, H.C. 2007. A Textbook of Fungi, Bacteria and Viruses. Vikas Publishing House Ltd., New Delhi – 10014
5. Salyers, A. A. and Whitt, D. D. 2001. Microbiology: diversity, disease, and the environment. Fitzgerald Science Press, Inc.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Soil Health & Fertility: Understand microbial roles in nutrient cycling (N, P, C, S) and improving soil structure for better plant growth.
CO2: Plant Growth Promotion: Identify and utilize beneficial microbes (like nitrogen-fixers, mycorrhizae) for enhanced nutrient uptake and stress tolerance.
CO3: Disease Management: Learn about plant pathogens and develop strategies for biological control using biocontrol agents and disease-resistant varieties.
CO4: Bioremediation: Apply microbial processes to degrade pollutants in soil and water, cleaning contaminated agricultural lands.

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/ Degree/ UG(R) /PG/Ph.D. Class: B. Sc. (Hons)Agriculture		Year: III
Credits: 2 Theory: 1 Practical: 1		Semester: VI
Course Code: AGR-327		Subject: Agriculture
Course Objectives: 1. To impart knowledge on issues related to lending to priority sector credit management and financial risk management		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian Agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks	3
II	Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit	3
III	Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports. Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian Agriculture.	3
IV	Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. 3 R's, 5 C's and 7 P's of credit.	3
V	Crop insurance: its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme). Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka (Nandini), Maharashtra and Punjab.	3

Practical

Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire first-hand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value-added products. Seminar on selected topics. Different types of repayment plans.

Reference / Text Books:

1. Gittinger, J.P. 1982. Economic Analysis of Agricultural Projects. The Johns Hopkins Univ. Press.
2. Reddy, S. S. and Ram, P.R. 1996. Agricultural Finance and Management. Oxford & IBH.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Identify agricultural credit: meaning, definition, need
CO2: Understand Assessment of crop losses
CO3: Identify Higher financing agencies
CO4: Understand Agricultural cooperation: philosophy and principles
CO5: Reorganization of cooperative credit structure in Andhra Pradesh and single window system

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/ Degree/ UG(R) /PG/Ph.D. Class: B. Sc. (Hons)Agriculture		Year : III
Credits: 3 Theory: 2 Practical: 1		Semester: VI
Course Code: AGR-328		Subject: Agriculture
Course Objectives: 1. To impart the fundamental knowledge on structure and function of cellular components, biomolecules and the biological processes in plants		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 02(In Hours/Week) Theory - 2 Hr. = 2 Credit(2Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Biochemistry – Introduction and importance, Properties of water, pH and buffer, plant cell and its components. Bio-molecules – Structure, classification, properties and function of carbohydrates, amino acids, proteins, lipids and nucleic acids.	3
II	Vitamins – physiological and metabolic role. Enzymes: General properties; Classification; Mechanism of action; Michaelis and Menten and Line Weaver Burk equation and plots;	3
III	Introduction to allosteric enzymes, use of enzymes. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle	3
IV	Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. Biosynthetic Pathways – Photosynthesis, Gluconeogenesis, nitrogen fixation, fatty acid and starch formation.	3
V	Regulation of metabolic pathways. Secondary metabolites, Terpenoids, Alkaloids, Phenolic and their applications in food and pharmaceutical industries.	3
Practical Preparation of standard solutions and reagents, Determination of pH, Qualitative tests of carbohydrates and amino acids, Quantitative estimation of soluble sugars and starch, Estimation of protein by Kjeldhal method and Lowry’s method, Preparation of mineral solution from ash, Estimation of fat by Soxhlet method, Determination of acid value, saponification value and iodine number, Estimation of ascorbic acid, Qualitative/quantitative tests of secondary metabolites.		
Reference / Text Books: 1. Nelson and Cox. 2008. Lehninger Principles of Biochemistry. Fourth/Fifth edition. Freeman (Can be downloaded)		

2. Conn, Stumpf, Bruening and Doi. 2006. Outlines of Biochemistry. Fifth Edition. Wiley
3. Horton, Moran, Rawn, Scrimgeour, Perry. 2011. Principles of Biochemistry. Fifth Edition. Pearson/Prentice Hall (Can be downloaded)
4. Heldt. 2005. Plant Biochemistry. Elsevier (Can be downloaded)
5. Goodwin and Mercer. 2005. Introduction to Plant Biochemistry. 2nd edition. CBS.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
CO1: Cellular Basis: Understand plant cell structure, organelles, and their biochemical functions.	
CO2: Biomolecules: Detail the structure, classification, and metabolism of carbohydrates, lipids, proteins, and nucleic acids in plants.	
CO3: Metabolic Pathways: Explain photosynthesis, respiration, nitrogen fixation, and secondary metabolite synthesis.	
CO4: Plant Physiology: Grasp the roles of plant hormones, minerals, and mechanisms of stress tolerance (e.g., antioxidants).	

IIMTU-NEP IMPLEMENTATION

Year: III / Semester: VI

Programme: Certificate/Diploma/ Degree/ UG(R) /PG/Ph.D.		Year: III
Class: B. Sc. (Hons)Agriculture		Semester: VI
Credits: 2 Theory: 1 Practical: 1		Subject: Agriculture
Course Code: AGR-329		Title: Fundamentals of Seed Science &Technology
Course Objectives: 1. To impart basic and fundamental knowledge on principles and practices seed science and technology 2. To impart practical skills on scientific seed production and post-harvest quality management		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 1, Practical 1 = 2 Credits		
L: 01 T: 00 P: 02(In Hours/Week) Theory - 1 Hr. = 1 Credit(1Hrs./Week=1Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to seed technology, definition and importance; Seed quality - definition, characters of good quality seed; Causes of deterioration of varietal purity and assessment of genetic purity, different classes of seed.	3
II	Foundation and certified seed production of important cereals, pulses and oilseed, field inspection, importance and procedures; Post-harvest seed quality management; seed processing procedures, seed drying	3
III	Seed treatment, its importance, method of application and seed packing; seed storage - general principles, stages and factors affecting seed longevity during storage;	3
IV	Seed health management during storage. Seed Certification and legislation; Seed Act and Seed Act enforcement, duty and powers of seed inspector	3
V	offences and penalties. Seeds Control Order 1983, basics of seed quality testing; New Seed Bill 2019; Seed quality enhancement techniques.	3
Practical Seed Structure, Seed sampling, Physical purity, Moisture determination, Germination test, Seed and seedling vigour test, Seed Viability, Genetic purity test: Grow out test, Field inspection, Seed health testing using blotter and agar plate method. Visit to seed production farms, seed testing laboratories and seed processing plant.		
Reference / Text Books:		
If the course is available as Generic Elective then the students of following departments may opt it.		

NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
Focus on understanding seed biology, development, and physiology, leading to practical skills in seed production, processing, quality testing, storage, marketing, and certification, ultimately aiming to develop entrepreneurial competence and ensure farmers receive high-quality, genetically pure seeds for improved agriculture	

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree /UG/PG/Ph.D.		Year: IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture
Course Code: UGE-411		Title: Agri-Business Management
Course Objectives: To impart knowledge on understanding the concepts processes, significance, and role of management and organizational behaviour.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Transformation of Agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries. Classification of industries and types of agro based industries	6
II	Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST and SWOT analysis. Management functions: Roles and activities, Organization culture. Planning, meaning, definition, types of plans.	6
III	Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control	6
IV	Capital management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting and positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC).	6
V	Sales and Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.	6

Suggested Readings:

1. Broadway, A.C. and Broadway, Arif, A. 2002. A textbook of Agri-Business Management. Kalyani Publishers
2. Bairwa, S.L. 2016. Objective on Fundamentals of Agri-business Management. Kalyani Publishers
3. Anjan Nishra, Debasish Biswas and Arunangshu Giri. 2019. Agribusiness Management, Himalaya Publishing House, 220p.
4. Shoji Lal Bairwa, Chandra Sen, L.K. Meena and Meera Kumari. 2018. Agribusiness Management Theory and Practices, Write and Print Publications.
5. Virender Kamalvanshi. Agribusiness Management. Random.

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

NA

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- Management Fundamentals: Understand core business functions (finance, HR, marketing, operations) within an agricultural context.
- Strategic Agribusiness: Develop business strategies for farming, food processing, retail, and related industries.
- Supply Chain Expertise: Master the logistics and management of agricultural supply chains, from farm to consumer.
- Technology & Innovation: Utilize digital tools and modern innovations in agriculture and agribusiness management.
- Policy & Ethics: Grasp the impact of agricultural policies, global trade, and ethical considerations.
- Entrepreneurship: Foster an entrepreneurial mindset to start and manage new ventures (agribusiness).
- Leadership & Communication: Build effective communication, teamwork, and leadership skills for diverse stakeholders.
- Sustainability: Understand and implement sustainable practices in the agricultural sector.

IIMTU-NEP IMPLEMENTATION
Year: IV/ Semester: VII

Programme: Certificate/Diploma/Degree /UG/PG/Ph.D.		Year : IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture
Course Code: UGE-412		Title: Management of natural resources
Course Objectives: 1. To enlighten students about available natural resources and their relationship with crop production 2. To impart the knowledge of principles and practices of natural resource management..		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources. Concern on Productivity issues. Ecological, social and economic dimension of resource management.	6
II	Land resources: Land as a resource. Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification. Landscape impact analysis, wetland ecology and management. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Water ecology and management.	6
III	Energy resources: Growing energy needs, renewable and non- renewable energy sources, use of alternate energy sources. Resource Management Paradigms: Resource management the evolution and history of resource management paradigms. Resource conflicts: Resource extraction, access and control system. Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies.	6
IV	Introduction to soil and water conservation and causes of soil erosion, Definition and agents of soil erosion, water erosion - Forms of water erosion, Gully classification and control measures. Soil loss estimation by universal soil loss equation - Soil loss measurement techniques. Principles of erosion control - Introduction to contouring, strip cropping. Contour bund - Graded bund and bench terracing.	6

V	Wind erosion - Mechanics of wind erosion, types of soil movement - Principles of wind erosion control and its control measures, Water harvesting techniques - Lining of ponds, tanks and canal systems.	6
Suggested Readings: 1. Sustainable Natural Resource Management by Danill R. Lynch. 2. Management of Natural Resource for Sustainable Development, by Vijay Singh Rathor and B S Rathor, Daya Publishing House. 3. Managing Natural Resources: Focus on Land and Water. Ed. Harikesh N. Mishra. PHI, Learning, 496p. 4. Management of Resources for Sustainable Development: Sushma Goel. The Orient Blackswan 284p. 5. Natural Resources: Their Conservation and Management by Arvindrai Upadhyay. Aspiration Academy, 320p. 6. Natural Resource Management for Growth Development and Sustainability by Vasudeva Srishti Pal. Today & Tomorrows Printers and Publishers, 336p		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40
Total:		100
Prerequisites for the course:		
Course Outcome		
• Understanding Principles: Grasping core concepts of sustainability, resource depletion, and the interconnectedness of natural systems. • Analyzing Impacts: Explaining how human activities (urbanization, consumption) affect resource generation, extraction, and the environment. • Developing Strategies: Creating effective, sustainable management plans for different resources (water harvesting, land use). • Evaluating Governance: Critically assessing governance models and policies for natural resources from various perspectives (social, economic, ecological). • Applying Tools: Using methods like Participatory Rural Appraisal (PRA) and Rapid Rural Appraisal (RRA) for resource assessment.		

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year : IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4	Subject: Agriculture	
Theory: 3		
Practical: 1		
Course Code: UGE-413		Title: Agrochemicals
Course Objectives:		
To impart knowledge on different classes of agrochemicals		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03		
T: 00		
P: 02(In Hours/Week)		
Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	An introduction to agrochemicals, their type and role in Agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in Agriculture, management of agrochemicals for sustainable Agriculture. Herbicides -Major classes, properties and important herbicides. Fate of herbicides. Fungicides- classification –Inorganic fungicides-characteristics, preparation and use of sulphur and copper.	6
II	Mode of action- Bordeaux mixture and copper oxychloride. Organic fungicides –Mode of action–Dithiocarbamates- characteristics, preparation and use of Zineb and maneb. Systemic fungicides-Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.	6
III	Introduction and classification and insecticides: inorganic and organic insecticides organochlorine, Ogranophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals. Insecticide Act and rules, Insecticides banned, withdrawn and restricted use. Fate of insecticides in soil and plant. IGR Biopesticides, Reduced risk insecticides, Botanical, Plant and animal systemic insecticides their characteristics and uses.	6
IV	Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate	6

V	Mixed and complex fertilizers: Sources and compatibility- preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistic and marketing. Plant bio-pesticides for ecological Agriculture, Bio-insect repellent.	6
Suggested Readings: 1. Buchel, K.H. (Ed.). 1992. Chemistry of pesticides. John Wiley & Sons 2. Panda, H. 2022. The Complete Technology Book on Pesticides, Insecticides, Fungicides and Herbicides (Agrochemicals) with Formulae, Manufacturing Process, Machinery & Equipment Details. 2nd Revised Edition. NPCS 3. Biswas, D. R. 2021. A Text Book of Fertilizers. New India Publishing Agency. 4. Singh, A. 2022. Basics of Agrochemical Formulations, Brillion Publishing, 176p. 5. Larramendy, M.L. 2017. Toxicity and Hazard of Agrochemicals, INTECH, 170p.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40
Total:		100
Prerequisites for the course:		
Course Outcome		
• Skilled professionals for the agriculture sector, capable of managing soil resources and improving crop yields. • Experts in plant protection and sustainable practices. • Awareness of environmental safety and potential for organic food production.		

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: B. Sc (Hons) Agriculture		Year : IV	
Credits: 4 Theory: 3 Practical: 1		Semester: VII	
Course Code: UGE-414		Subject: Agriculture	
Course Objectives: 1. To educate the students on designing different styles and types of gardens 2. To enable the students to identify different ornamental plants and their utilization in landscaping design. 3. To enable students to design landscapes in softwares like AUTOCAD, ARCHCADE etc.		Title: Landscaping	
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses			
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits			
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)			
Unit	Contents	No. of Lectures Allotted	
I	Importance and scope of landscaping. Principles of landscaping, garden styles and types terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery water garden, walk-paths, bridges, other constructed features etc.	6	
II	Gardens for special purposes. Trees: selection, propagation, planting schemes, canopy management. Shrubs and herbaceous perennials: selection, propagation, planting. schemes, architecture.	6	
III	. Climber and creepers importance, selection, propagation, planting. Annuals: selection, propagation, planting scheme. Other garden plants: palms, ferns, grasses and cacti succulents.	6	
IV	Pot plants: selection, arrangement, management. Bio- aesthetic planning: definition, need, planning.	6	
V	Landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions, Bonsai principles and management. Lawn: establishment and maintenance. CAD application.	6	
Suggested Readings: 1. Textbook of floriculture and landscaping by Anil K. Singh and Anjana Sisodia 2. Principles of Landscape Gardening: Y. Chandrasekhar and Hemla Naik B. 2020. ICAR.			

3. Introductory Ornamental Horticulture and Landscape Gardening: Rajaneesh Singh and Brijendra Kumar Singh. 2020, Bio-Green Books.
4. Principles of Landscape Architecture: Pragnyashree Mishra and Bhimasen Naik. 2022. New India Publishing Agency.
5. Landscape Gardening: Sudhir Pradhan. 2018. Scientific Publishers India.

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

NA

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- Design and create garden plans, rockeries, water features, and vertical gardens.
- Manage planting, maintenance, and installation of landscapes.
- Advise on plant selection for specific climates and aesthetic goals.
- Understand the environmental impacts and benefits of landscape practices.
- Work autonomously or as part of a team in landscape design or maintenance roles.

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year : IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture
Course Code: UGE-415		Title: Commercial Plant breeding
Course Objectives: 1. To discuss about hybrid development and various crop improvement aspects of field crops viz., rice, wheat, maize, pearl millet, sorghum, pigeonpea, chickpea, green gram, black gram, lentil, soybean, groundnut, rapeseed-mustard, cotton etc. 2. To provide understanding on tissue culture and biotechnological approaches as alternative strategies for development of line and cultivars 3. To impart knowledge on seed production, release and notification of varieties and PPV&FR Act, 2001		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Types of crops and modes of plant reproduction. Line development and maintenance breeding in self- and cross- pollinated crops (A/B/R and two-line system) for development of hybrids and seed production.	6
II	Genetic test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc.	6
III	Speed Breeding, Breeding Management systems, High-throughput phenol typing and genotyping platforms, Quality seed production of vegetable crops under open and protected environment.	6
IV	Alternative strategies for the development of the line cultivators: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV and FR Act.	6
V	Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self- and cross-pollinated crops.	6

Suggested Readings:

1. Commercial Plant Breeding at a glance by Phundan Singh, Pratibha Bisen, Reshu Tiwari. Daya Publishing House.
2. Plant Breeding: Principles and Methods by B. D. Singh. Kalyani Publishers.
3. Principles of Plant Breeding (1st & 2nd Edition) by R.W. Allard.
4. Breeding Field Crops by J.M. Poehlman.
5. Commercial Plant Breeding Objective: Phundan Singh, Mridula Billore and Monika Singh. Astral Publishing, 160p.
6. Breeding and Crop Production: H. Padmalatha, Random.
7. Biotechnology for Agricultural Breeding: Mangal, S. K. GeneTech Books.

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

NA

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- Enables students to master classical to molecular breeding, design crop improvement programs (self/cross-pollinated), use biotechnology, conduct hybrid seed production, perform genetic purity tests (molecular/field), understand IPR/variety release, and apply skills for high-yield, quality seed development, leading to roles in agribusiness or research

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree /UG/PG/Ph.D.		Year : IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture
Course Code: UGE-416		Title: Food safety and standards
Course Objectives: 1. To develop the skills to convert raw materials into safe, attractive food products 2. To manage the production of food products 3. To use scientific knowledge to develop new products		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Food safety –Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Type of Hazards - Biological, Chemical Physical hazards. Management of hazards – Need.	6
II	Control of Parameters. Temperature Control. Food Storage. Production Design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene.	6
III	Food safety Measures. Food Safety Management Tool-Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM-concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene.	6
IV	Food laws and Standards Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food. Recent concerns-New and Emerging Pathogens. Packaging,	6
V	Product labelling and Nutritional labelling. Genetically modified food/transgenic. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.	6

Suggested Readings:

1. Text book of Food Science and Technology: Avantina Sharma.
2. Handbook of Food Safety: D.S.L. Khatekar and N. Sarkate. Step Up Academy, 576p.
3. Food and Beverage Management: Bernard Davis. Andrew Lockwood, Ioannis Pantelidis, Peter Alcott Routledge
4. Food safety and Quality Control: Pulkit Mathur. The Orient Blackswan.332p.
5. Safe Food Handling: HACCP booklet for Food Handlers. Cletus Fernandes, Notion Press.

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

NA

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- Understand Regulations: Grasp national (FSSA) and international food laws, standards, and regulations, including Codex, ISO, and EU directives.
- Implement Safety Systems: Apply HACCP (Hazard Analysis and Critical Control Points) and GMP (Good Manufacturing Practices) for process control.
- Manage Hazards: Identify, assess, and control biological, chemical, and physical hazards in food production.
- Ensure Quality Control: Use subjective and objective methods (taste panels, analysis) to evaluate food quality (appearance, texture, flavor) and detect adulteration.
- Maintain Hygiene: Understand and implement personal hygiene, sanitation, and waste disposal in food service.
- Analyze Food: Know principles of food analysis, water quality, and nutritional labeling.
- Develop Strategies: Create food safety management systems and strategies for risk management, product design, and packaging.

IIMTU-NEP IMPLEMENTATION
Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree /UG/PG/Ph.D.		Year: IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4		Subject: Agriculture
Theory: 3		
Practical: 1		
Course Code: UGE-417		Title: System Simulation and Agro-advisory
Course Objectives: 1. To impart the knowledge of statistical and simulation modelling in crop yield estimation 2. To get acquainted with different weather forecasting techniques and their usability analysis 3. To study about the preparation and dissemination of agro-advisory bulletin		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	System approach for representing soil-plant-atmospheric continuum, system boundaries. Crop models, concepts and techniques, types of crop models, data requirements, relational diagrams	6
II	Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis.	6
III	Potential and achievable crop production- concept and modelling, techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance.	6
IV	Weather forecasting, types methods, tools and techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast.	6
V	Use of crop simulation model for preparation of Agro- advisory and its effective dissemination.	6
Suggested Readings: 1. Introduction to Agrometeorology by H. S. Mavi. 2. Agricultural Meteorology by G.S.L.H.V. Prasado Rao. 3. Advances in Plant Atmospheric Interactions (Eds. Rao, V.U.M., Rao, A.V.M.S., Rao, G.G.S.N., Ramana Rao, B.V., Vijaya Kumar, P. and Venkateswarlu, B), Central Research Institute for Dryland Agriculture (CRIDA), Santoshnagar, Hyderabad. 4. Text Book of Agricultural Meteorology by M.C. Varshneya and P.B. Pillai. ICAR. 5. Principles of Agricultural Meteorology by OP Bishnoi.		

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

NA

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- Crop Modeling: Understand and apply crop simulation models (like DSSAT), including calibration, validation, and sensitivity analysis for different scenarios.
- Agro-advisory Development: Create effective advisories using weather forecasts (short/medium range), crop calendars, and simulation outputs for pest/disease management and resource optimization.
- Yield Forecasting: Estimate potential and achievable crop production and forecast yields using models and statistical methods.
- Resource Management: Simulate crop responses to limited water and nutrients to advise on efficient management strategies.
- Data Analysis: Utilize statistical tools for analyzing meteorological and crop data for forecasting and decision support.
- Decision Support: Integrate simulation with Decision Support Systems (DSS) to provide actionable guidance for farmers, transforming uncertainty into informed choices.

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year : IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4		Subject: Agriculture
Theory: 3		
Practical: 1		
Course Code: UGE-418		Title: Hi-tech Horticulture
Course Objectives: 1. To educate the students on the latest technology of hi-tech horticulture 2. To educate students on the concepts and prospects of hi-tech horticulture		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction and importance; Nursery management and mechanization; micro propagation of horticultural crops;	6
II	Modern field preparation and planting methods; Protected cultivation: advantages, controlled conditions, method and techniques	6
III	Micro irrigation systems and its components; EC, pH based fertilizer scheduling; canopy management; high density orcharding	6
IV	Components of precision farming: Remote sensing; Geographical Information System (GIS); Differential Geo-positioning System (DGPS); Variable Rate Applicator (VRA)	6
V	application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.	6
Suggested Readings: 1. Hi-tech Horticulture by T.A. More. 2. Greenhouse Operation and Management by Paul V. Nelson. 3. Hi Tech Horticulture (Pb) by S. Prasad, Dharam Singh and R.L. Bharadwaj. Agrobios 4. Instant Horticulture by S.N. Gupta. Jain Brothers. 488p. 5. Hydroponics for Beginners and Advanced: The Ultimate Hydroponic and Aquaponic Gardening Guide by Tom Garden, Webb Eleanor.		
If the course is available as Generic Elective then the students of following departments may opt it.		
NA		

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Outcome	
• Technical Proficiency: Design and manage protected structures (polyhouses, tunnels, shade nets) and implement precision techniques like drip irrigation, fertigation, and hydroponics. • Crop Management: Master advanced production practices for high-value horticultural crops, focusing on enhanced productivity and quality. • Entrepreneurship: Develop skills for profitable ventures in horticulture, including establishing nurseries, value addition, and marketing. • Technology Integration: Understand and apply concepts like tissue culture, remote sensing, and AI in horticulture. • Problem Solving: Address challenges in diverse soil conditions (saline, waterlogged) and terrain. • Research & Extension: Contribute to knowledge dissemination and research in horticultural sciences.	

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year : IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4		Subject: Agriculture
Theory: 3		
Practical: 1		
Course Code: UGE-419		Title: Protected cultivation
Course Objectives:		
1. To educate students on the scientific and commercial cultivation of important value-added products in protected cultivation		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03		
T: 00		
P: 02(In Hours/Week)		
Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Protected cultivation- importance and scope, status of protected cultivation in India and World, types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house.	6
II	Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management.	6
III	Types of benches and containers, Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops.	6
IV	Greenhouse cultivation of important horticultural crops-rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants etc.	6
V	Cultivation of economically important medicinal and aromatic plants. Off- season production of flowers and vegetables. Insect pest and disease management.	6
Suggested Readings:		
1. Greenhouse operation and management by Paul V. Nelson.		
2. Protected cultivation of Horticultural crops by Madan Kr. Jha, Sujan Singh Paikra and Manju Rani Sahu.		
3. Protected Cultivation of Horticulture Crops by Itigi Prabhakar. IBPSS.		
4. Advances in Protected Cultivation by Brahma Singh and Balraj Singh. NIPA,252p.		
5. Protected Cultivation and Smart Agriculture by Eds. Sagar Maitra, Dinkar J. Gaikwad and Tanmoy Shankar. New Delhi Publishers, 263p.		
6. Textbook of Protected Cultivation and Precision Farming for Horticultural Crops by B. Ashok Kumar, Eggadi Ramesh and Sindhu V. Jain Brothers.		

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

NA

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- Technical Knowledge: Understand the principles, construction, and components of protected structures (polyhouses, net houses, tunnels).
- Crop Management: Learn cultivation practices for various crops (vegetables, flowers, MAPs) in protected environments, including seed starting, irrigation, nutrient management, and pest/disease control.
- Environmental Control: Master techniques for managing temperature, humidity, ventilation, and light using both manual and automated systems (microcontrollers, IoT).
- Soilless Culture: Gain practical knowledge in hydroponics, aeroponics, and other soilless growing media.
- Entrepreneurship & Economics: Develop skills for setting up profitable ventures, marketing produce, and understanding the economic aspects of high-tech horticulture.

IIMTU-NEP IMPLEMENTATION
Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D. Class: B. Sc (Hons) Agriculture		Year : IV Semester: VII
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture
Course Code: UGE-420		Title: Biotechnology of Crop Improvement
Course Objectives: 1. To acquaint with biotechnological tools of crop improvement 2. To know about direct and indirect methods of gene transfer 3. To introduce about gene editing in plants 4. To provide knowledge about marker assisted breeding and genomic selection		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Impact of Biotechnology on crop improvement and the perspective of society; Various biotechnological techniques available for crop improvement – Plant Tissue Culture, Genetic Engineering, Genome editing, Marker Assisted breeding and Genomic Selection. Biosafety regulations and their application in Agricultural Biotechnology.	6
II	Somaclonal variation and its use in crop improvement; embryo culture; anther/pollen culture; somatic embryogenesis; artificial seeds; techniques of protoplast culture, regeneration and somatic cell hybridization, achievements and limitations, utility in the improvement of crop plants.	6
III	Direct and Indirect methods of gene transfer in plants - Agrobacterium-mediated gene transfer in dicots and monocots; Direct DNA delivery methods (microinjection, particle gun method, electroporation); gene targeting; Gene silencing techniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; principle and application of gene silencing; creation of transgenic plants; debate over GM crops; introduction to methods of genetic manipulation in different model systems.	6

IV	Introduction to genome editing – Various tools of genome editing; CRISPR-Cas9 with specific emphasis on Indian regulations; Cloning genomic targets into CRISPR/Cas9 plasmids; electroporation of Cas9 plasmids into cells; purification of DNA from Cas9 treated cells and evaluation of Cas9 gene editing; in vitro synthesis of single guide RNA (sgRNA); using Cas9/sgRNA complexes to test for activity on DNA substrates; evaluate Cas9 activity by T7E1 assays and DNA sequence analysis; Applications of CRISPR/cas9 technology in crop plants.	6
V	Marker Assisted Breeding and Genomic Selection: Introduction to various DNA-based markers and their use in marker-assisted breeding; Foreground Selection, Recombinant Selection and background Selection; Marker-assisted backcross breeding, marker-assisted selection – success stories; Introduction to Genomic Selection.	6
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40
Total:		100
Prerequisites for the course:		
Course Outcome		
- Develop new crop varieties resistant to pests/diseases or tolerant to drought/salinity. - Design and implement molecular breeding programs. - Evaluate the impact of GMOs on health and the environment. - Use modern tools (like CRISPR/Cas9, though often implied) for precise gene editing. - Address global food security challenges through innovation in crop science.		

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: IV
Class: B. Sc (Hons) Agriculture		Semester: VII
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture
Course Code: UGE-421		Title: Micro-propagation Technologies
Course Objectives: To educate the students in detail about the sterilization techniques for explants, preparation of stocks and working solution, culturing of explants, regeneration of whole plants from different explants and hardening procedures.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction, History, Advantages and limitations.	6
II	Types of cultures (seed, embryo, organ, callus, cell); Stages of micro propagation;	6
III	Axillary bud proliferation (Shoot tip and meristem culture, bud culture);	6
IV	Organogenesis (calluys and direct organ formation); Somatic embryogenesis;	6
V	Cell suspension cultures; production of secondary metabolites; Somaclonal variation; Cryopreservation.	6
Suggested Readings: 1. Basics of Horticulture by Jitendra Singh 2. Introduction to Horticulture by N. Kumar 3. Handbook of Horticulture by ICAR. 4. Plant Tissue Culture: Basic and Applied by Timir Baran Jha and Biswajit Ghosh. Platinum Publishers. 439p.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		20
2. Presentations /Seminar/Assignments/internal		20
3. Practical/Research Project Report/Seminar On Research Project Report		20
4. ESE		40

Total:	100
Prerequisites for the course:	
Course Outcome	
• Understand the principles of plant tissue culture, including cellular totipotency and how plant hormones (auxins, cytokinins) regulate growth. • Master laboratory techniques such as media preparation (e.g., Murashige and Skoog medium), sterilization methods for media, instruments, and explants, and aseptic inoculation procedures. • Execute the stages of micropropagation through various methods (axillary bud proliferation, organogenesis, somatic embryogenesis)	

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year : IV
Class: B. Sc (Hons) AGRICULTURE		Semester: VII
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture
Course Code: UGE-422		Title: Commercial Seed Production
Course Objectives: To introduce the basic principles of planting material production at commercial scale and seed quality evaluation.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	General Principles of Seed Production: Raising the seed crop, Introduction, Procurement of a class of Improved seeds, Reporting to Monitoring or certification Agency, Principles and practices of selection of area and agronomic requirement of seed production of field crops, Importance of isolation distance and Rouging, Principles of hybrid seed production in field crops, Principles and practices of selection of area and agronomic requirement of seed production of horticultural crops, Concept of apomixes, male sterility and self-incompatibility and its application in hybrid seed production of horticultural crops, Farmers participatory seed production.	6
II	General Principles of Seed Processing: Introduction, Objectives of Seed Processing, Seed Drying, Principles of Drying, Water vapour equilibrium, Methods of drying seeds, Cleaning and grading, Air and screen machines, Dimensional separators, Density separators, Surface texture separators, Colour separators, Spiral separators, Electric separators, Vibrator separators, Separation based on Affinity to liquids, Seed treatment, Temperature treatment, Chemical treatment, Bagging and Labelling. General Principles of Seed Testing: Seed testing-Introduction, Procedure of Seed testing, components of seed quality testing genetic, physical, physiological and seed health testing, Seed sampling, Types of seed sampling, Requirements of sampling, Concept of seed viability and vigour; dormancy, types and principles of seed dormancy, Physiological quality of seed, Principles of seed Germination, types of germination, biochemical and genetic basis.	6

III	Seed Certification: History, concept and objectives of seed certification; seed certification agency/organization and staff requirement Indian Minimum Seed Certification Standards (I.M.S.C.S.) - general and specific crop standards including GM varieties, field and seed standards.	6
IV	Seed Industry and Seed Marketing: Introduction, Evolution of the seed industry, Development of the vegetable and Flower seed industry, Seed marketing – concept, definition and purpose, importance and promotion of quality seed, formal and informal seed supply systems, Seed marketing intelligence and product mix, sales promotion, distribution channels, marketing costs and margins; packaging and labelling, Seed Associations, Factors influencing seed marketing, Seed marketing programs, Seed industry organizations, Marketing of public versus private players, Demand and supply of seed; role of seed replacement rate (SRR), seed multiplication ratio (SMR), economics of seed production; determining seed needs, Seed pricing and price policy, seed processing and / packaging, demand forecasting and factors affecting demand for seeds, effect of price and farm income on seed demand, Role of WTO in seed marketing.	6
V	Biotechnology in Seed Technology: History of plant tissue culture, Laboratory organization, Composition of nutrient medium, Micro-propagation, Axillary bud proliferation approach, Meristem and shoot tip culture, Bud culture, Advantages of Micro-propagation, Problems associated with micro-propagation, Synthetic seed production, Types of synthetic seeds, methods of development of synthetic seeds, Components of nutrient media for synthetic seed development, Storage of synthetic seeds, Advantages and limitations of synthetic seed production.	6

Suggested Readings:

1. Agarwal, R.L. 1997. Seed Technology. 2nd edn. Oxford & IBH.
2. McDonald, M.B. Jr and Copeland, L.O. 1997. Seed Production: Principles and Practices. Chapman & Hall
3. Thompson, J.R. 1979. An Introduction to Seed Technology. Leonard Hill.
4. Singhal, N.C. 2003. Hybrid Seed Production in Field Crops. Kalyani.
5. Justice, O.L. and Bass, L.N. 1978. Principles and Practices of Seed Storage. Castle House Publ. Ltd.
6. Tunwar, N.S. and Singh S.N. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
7. Chawla, H.S. 2008. Introduction to Plant Biotechnology. 2nd edn. Oxford & IBH publishing Co. Ltd. 113-B Shahpur Jat, New Delhi-110049.

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

NA

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- To understand quality seed principles, manage entire production cycles (planning, planting, pollination, roguing, harvesting, processing, storage), master Indian Seed Certification Standards (IMSCS) and legalities,
- Develop skills to become entrepreneurs in the seed industry, ensuring high genetic purity and yield for various crops like cereals, oilseeds, vegetables, and ornamentals.

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: B. Sc (Hons) AGRICULTURE		Year : III Semester: VII	
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture	
Course Code: UGE-423		Title: Principles and Practices of Organic Farming and Conservation Agriculture	
Course Objectives: 1. To teach students the principles of crop production under organic and conservation Agriculture situation 2. To impart practical knowledge of organic and conservation Agriculture practices			
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses			
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits			
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)			
Unit	Contents	No. of Lectures Allotted	
I	Concept of organic farming, principles and its scope in India; Choice of crops and varieties in organic farming; Nutrient management in organic farming and their sources; Fundamentals of insect, pest,	6	
II	disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and crop standards of organic farming; Processing, labelling, economic considerations and viability, marketing and export potential of organic products.	6	
III	Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic Agriculture. Conservation Agriculture: definition, origin, principles, advantages, challenges;	6	
IV	Primary practices in conservation Agriculture: minimum soil disturbance, crop residue retention, and crop diversification, complementary practices, conservation Agriculture vis a vis Climate Smart Agriculture;	6	
V	Organic manures- recommended doses and application in comparison to inorganic fertilizers for major crops.	6	

Suggested Readings:

1. A.C. Gaur. Handbook of Organic farming and biofertilizers.
2. A.K. Dahama. Organic Farming for Sustainable Agriculture. Agrobios (India), Jodhpur.
3. Arun. K. Sharma. Handbook of Organic Farming. Agrobios (India), Jodhpur.
4. S.P. Palaniappan and K. Annadurai. Organic Farming – Theory and Practice. Scientific Publishers. Jodhpur.
5. U. Thapa and P. Tripathy. Organic Farming in India- Problems and Prospects. Agrotech publishing agency, Udaipur.
6. G.K. Veeresh. Organic Farming. Foundation Books. New Delhi.
7. Purshit, S.S. Trends in Organic Farming in India. AgrosBios (India), Jodhpur.
8. Thampan, P.K. Organic Agriculture. Peckay tree Crops Development Foundation, Cochin, Kerala.
9. Sathe, T.V. Vermiculture and Organic Farming. Days Publishing House, New Delhi.
10. Singh, Abhinandan, Pankaj Kumar Ojha and Rahul Kumar, 2018. Conservation Agriculture Technologies. Biotech Books.
11. Acharya Sankar Kr, Sreemoyee Bera, Cornea Saha, Prabhat Kumar, Monirul Haque, Riti Chatterjee and Anwesha Mandal. 2022. Conservation Agriculture Approach and Application. Scholars World. 292p.

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

NA

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- Focus on understanding core principles (health, ecology, fairness, care) and implementing sustainable practices like soil building (compost, bio-fertilizers),
- Students enable to integrated pest/nutrient management, crop rotation, water conservation, and organic certification, empowering
- Learners to create eco-friendly, productive systems that protect resources and human health.

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/Degree /UG/PG/Ph.D.		Year : III
Class: B. Sc (Hons) AGRICULTURE		Semester: VII
Credits: 4		Subject: Agriculture
Theory: 3		
Practical: 1		
Course Code: UGE-424		Title: Post Harvest Technology and Value Addition
Course Objectives: 1. To educate about the different pre-harvest, harvest and post-harvest factors affecting the post-harvest life of fruits and vegetables 2. To educate about preparation techniques of value-added products 3. To educate about the different dehydration techniques of horticultural crops		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Importance of post –harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses.	6
II	Pre-harvest factors affecting post-harvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate.	6
III	Harvesting and field handling; Storage (ZECC, cold storage, CA, MA and hypobaric); Value addition concept; Principles and methods of preservation.	6
IV	Intermediate moisture food (jam, jelly, marmalade, preserve, candy) - concepts and standards; Fermented and non-fermented beverages. Tomato products - concepts and standards.	6
V	Drying /Dehydration of fruits and vegetables –concept and methods, osmotic drying. Canning – concepts and standards, packaging of products.	6
Suggested Readings: 1. Post-harvest technology of horticultural crops by S.K. Sharma and M.C Nautiyal. 2. Post-Harvest Technology by Suja Nabi Qureshi, Kounser Javeed and Abhay Kumar Sinha. Bioscientific Publishers. 3. Postharvest Technology of Horticultural Crops by K.P. Sudheer and V. Indira. New India Publishing Agency. 320p.		

4. Postharvest Management and Value Addition by Aswini Kumar Goel, Rajender Kumar and Satwinder S. Mann. Daya Publishing House.
5. Postharvest Management and Value Addition of Fruits and Vegetables by Kureel M.K. Biotech, 181p.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100
Prerequisites for the course:	
Course Outcome	
- Students will acquire knowledge on post-harvest management tools and novel packaging techniques. - Students will gain practical skills in reducing food loss, extending shelf life, and increasing profitability by applying processing, preservation (drying, canning, fermenting, etc.), packaging, and storage techniques to fruits and vegetables. - Enabling them to develop new products and boost farmer income while ensuring year-round availability and quality.	

IIMTU-NEP IMPLEMENTATION

Year: IV / Semester: VII

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: III
Class: B. Sc (Hons) AGRICULTURE		Semester: VII
Credits: 4 Theory: 3 Practical: 1		Subject: Agriculture
Course Code: UGE-425		Title: Food Science and Nutrition
Course Objectives: 1. To impart knowledge on the biochemical aspects of various nutrients and their interactions in foods during processing, storage and deterioration		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 50% Marks / Theory 3, Practical 1 = 4 Credits		
L: 03 T: 00 P: 02(In Hours/Week) Theory - 3 Hr. = 3 Credit(3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction on fundamentals of foods and human nutrition; Basic food groups; Concept of balanced diets; Recommended Daily Allowances (RDA) for various age groups.	6
II	Biochemical composition, energy and food value of various food grains, fruits and vegetables; Carbohydrates, proteins, fats as nutrients and their interactions, Physio-chemical, functional and nutritional characteristics of essential nutrients- sources and functions,	6
III	Nutritional requirements, malnutrition, inborn errors of metabolism, deficiency diseases; Digestion, absorption, transport and metabolism of nutrients in human system; Protein quality evaluation.	6
IV	Biochemical and nutritional aspects of vitamins, minerals, nutraceuticals, antioxidant, antinutritional factors and biochemistry of postharvest storage, losses during processing. Effect of cooking, processing and preservation on nutrients of different food products.	6
V	biochemical aspects of food spoilage; Food fads, food safety and quality standards. Enzymes in food industry, food additives, nutritional quality of plant, animal, dairy, marine and fermented products.	6
Suggested Readings: 1. Damodaran, S. and Parkin, K.L. (Ed.). 2017. Fennema's Food Chemistry. CRC Press 2. Gibney, M.J., Lanham-New, S.A., Cassidy, A. and Voster, H.H. (Ed.). 2009. Introduction to Human Nutrition. Wiley-Blackwell.		

3. Trueman, P. 2007. Nutritional Biochemistry. MJP Publishers.
4. Rekhi, Tejmeet and Yadav, Heena. 2014. Fundamentals of Food and Nutrition. Elite Publishing House. 257p.
5. Dharmesh Kumar. Food Science and Nutrition. Random.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	20
2. Presentations /Seminar/Assignments/internal	20
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	40
Total:	100

Prerequisites for the course:

Course Outcome

- Understanding food's composition, processing, and nutritional impact on health.
- Enabling graduates to design diets, develop food products, manage food services, and apply scientific principles to solve public health issues like malnutrition and food safety.
- Graduates learn to assess nutritional status, plan therapeutic diets, and understand food microbiology.
- Use knowledge for health promotion and clinical intervention, becoming researchers, dietitians, or food scientists

IIMTU-NEP IMPLEMENTATION
Year: IV / Semester VIII

Sr. No.	Course title	Total credits
1.	For student opting 4 year BSc. (Hons.) degree Student READY (RAW) / Experiential Learning / Hands on Training / Industrial Attachment /Project Work / Internship etc.	20
	Total	20

SKILL ENHANCEMENT COURSE (SEC)

A student admitted into 1st year of B.Sc. (Hons) Agriculture degree program will take 2 skill enhancement courses each of 2 credits in each semester of first year. Likewise, the student continuing his study into 2nd year of B.Sc. (Hons) Agriculture will undergo 1 skill enhancement course of 2 credits in each of the 2 semesters of 2nd year.

The student can select these courses from a bouquet of skill enhancement courses as indicated below or courses offered by a college. The courses may be offered as module of complementing courses to help the student to achieve skill in a specific area of his interest.

The University/HAEIs may offer such skill enhancement courses in which it has strength/ expertise as well as there is prospect of local employment and entrepreneurship development. The courses included in the list are indicative and the University/HAEIs may add more need-based courses in the list depending on their facilities and expertise available.

Indicative skill Enhancement courses

Sr. No.	Course title	Total credits
1.	Biofertilizer and biopesticide production	2 (0+2)
2.	Production Technology of Bioagents	2 (0+2)
3.	Seed Production and Testing Technology	2 (0+2)
4.	Mushroom Production Technology	2 (0+2)
5.	Soil, Plant and Water Testing	2 (0+2)
6.	Post-harvest Processing Technology	2 (0+2)
7.	Beneficial Insect Farming	2 (0+2)
8.	Plantation Crop Production and Processing	2 (0+2)
9.	Poultry Production Technology	2 (0+2)
10.	Piggery Production Technology	2 (0+2)
11.	Commercial Horticulture	2 (0+2)
12.	Floriculture and Landscaping	2 (0+2)
13.	Food Processing	2 (0+2)
14.	Agriculture Waste Management	2 (0+2)
15.	Organic Production Technology	2 (0+2)
16.	Commercial Sericulture	2 (0+2)
17.	Video Production	2 (0+2)

ONLINE COURSES

The students will have to take a minimum of 10 credits of online courses (as per UGC guidelines for online courses) as a partial requirement for the B.Sc. (Hons) Agriculture.

The online courses can be from any field such as Basic Sciences, Humanities, Commerce, Business Management, Languages including foreign language, Communication skills, Music, etc. and can be taken from SWAYAM, Diksha, NPTEL, mooKIT, edX, Coursera, or any other portal.

The objective is to allow the students to groom their passion or strengthen their knowledge and competency in any field beyond prescribed courses.

The students will take prior approval of the courses they opt from the concerned Dean/Assoc. Dean/Principal of the Faculty/College/Institute.

The courses will be non-gradual as separate certificates would be issued by the Institute/ University offering the courses.

However, the University/ institute will keep a record of such courses registered and completed by each student and will indicate the title of the (successfully completed) courses in final transcript issued to the student.

SCHOOL OF AGRICULTURE SCIENCE

ACADEMIC HAND BOOK



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O-Pocket, Ganga Nagar, Mawana Road, Meerut-250001

Post Graduate Programme
(New Restricted Syllabus as per ICAR 5th Dean's committee
w.e.f. 2022-23)
(Academic Session 2025-26)

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1. PREAMBLE:

In the M.Sc. Agronomy program, students delve into the principles and practices that govern crop production, plant physiology, soil science, pest and disease management, and crop improvement techniques. The curriculum is designed to provide a comprehensive understanding of the interactions between plants, soils, climate, and agricultural management practices, with a strong emphasis on sustainable and environmentally-friendly approaches.

The program's primary objective is to develop competent agronomists who can apply scientific research and innovation to optimize crop yields, enhance agricultural productivity, and promote resource-efficient farming methods. Through a combination of theoretical knowledge and practical experience, students are encouraged to explore the latest advancements in agronomy and develop critical thinking skills to address real-world agricultural challenges. M.Sc. in Agronomy prepares graduates for diverse career paths in agricultural research, crop consulting, sustainable agriculture development, academia, and policymaking. By equipping students with a strong scientific foundation and practical skills, the program empowers them to contribute positively to the global agricultural landscape and address the growing demand for food production in a sustainable and responsible manner.

2. DEFINITIONS AND NOMENCLATURE:

In these Regulations, unless the context otherwise requires:

1. “Programme” means Degree Programme like B.Sc. (Hons) Agriculture/ M. Sc. Agriculture /Computer Science / AIML / Civil / Electrical/Mechanical / Aerospace / Electronics & Communications / Electrical / Electronics & Instruments/IT/bio-Tech branch of B.Tech. Degree Programme.
2. “Course” means a theory or practical subject that is normally studied in a semester.
3. “Vice – Chancellor of IIMT-University” means the Head of the University.
4. “Registrar” is the Head of all academic and General Administration of the University.
5. “Dean” means the authority of the school that is responsible for all academic activities of various programmes and implementation of relevant rules of these Regulations pertaining to the Academic Programmes.
6. “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.
7. “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 meet.
8. “HoD” means the Head of the Department concerned.
9. “University” means IIMT-University, Meerut.
10. “TCH” means Total Contact Hours – refers to the teaching – learning periods.
11. “DEC” means Department Exam Committee.
12. “BoS” means Board of Studies.
13. “ACM” means Academic Council meeting the highest authoritative body for approval for all Academic Policies.
14. “Class Co-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.
15. “IA” is Internal Assessment which is assessed for every student for every course during the semester.

16. “ESE” is End Semester Examination conducted by the University at the End of the Semester for all the courses of that semester.
17. “UGC” means University Grants Commission.
18. “MHRD” means Ministry of Human Resource Development, Govt. of India.
19. “AICTE” means All India Council of Technical Education.
20. “HEI” means Higher Education Institutions.

3. VISION AND MISSION:

VISION:

To produce agricultural graduates with high knowledge and competence by imparting practical technical education through innovative and analytical approach with an objective to create valuable manpower for sustainable agriculture, Argo- Industry and contribution to the society.

MISSION:

- (i) To provide the best possible infrastructure and facilities for innovative teaching and learning agricultural and horticultural subjects.
- (ii) To establish a centre of excellence to promote academia – Agro-Industry interface and partnerships for enthusing competence of students as per needs of the Industry.
- (iii) To empower students with latest agricultural and Agronomic techniques and skills to promote their employability and encourage them to become agro-entrepreneurs, with emphasis on practical-oriented teaching to develop skills and analytical capability of students.

4. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO-1: To provide the sound knowledge in the Agriculture and allied science subjects required to solve common problems in management of crop cultivation, improvement, livestock rearing and their marketing.

PEO-2: To develop a good teaching-learning environment for higher studies and help in selection of professional careers in government and private organization, agro- based industries, educational/ research/extension, institutes *etc.*

PEO-3: To develop the skills for leadership, ethical integrity, and professional engagement in agriculture and allied science.

PEO-4: To provide adequate information about natural and other resources through a course curriculum for the betterment of life.

PEO-5: To produce highly skilled professionals in field of various branches of agriculture to meet the need of various scientific agriculture institutions as well as farmers demand for agriculture professionals.

5. PROGRAMME OUTCOMES (POs):

P.O.1. Understand the basic knowledge of agriculture and related subjects in the current scenario of Indian and world Agriculture.

P.O.2. Develop an understanding of communication methods, resources utilization, cultivation of crops, management of crops, and value addition of agricultural produces.

P.O.3. Develop the skills to manage agricultural farms, enhance quality of farm- produces and their commercial utilization.

P.O.4. Demonstrate the methods used in collection, presentation of data and analysis of results

of experiments in laboratories and fields and their validation.

P.O.5. Understand all related methods in agriculture to increase the profit from crop fields and livestock.

P.O.6. Learn to make optimum decision at various levels that enhances the success as an agricultural enterprise.

P.O.7. Extension activities in agriculture and allied sectors around the local villages through Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE & AIA).

P.O.8. Harmonize the relation with Agriculture Research Institutions, State Agriculture Universities, Krishi Vigyan Kendra (KVK), *etc.*

P.O.9. Motivate for entrepreneurship, start-up through project planning and execution, research and training during field visits *etc.*

6. PROGRAMMES SPECIFIC OUTCOMES (PSOs):

P.S.O.1. Develop the knowledge based resources and technologies for the enhancement of decision-making ability in students for selection of higher studies in Agriculture.

P.S.O.2. Demonstrate the thoughts of the legal and ethical issues of the environment impacting agriculture and food security of the local and global population.

P.S.O.3. Establish a self-motivated system of agriculture education to attain the local and global demands of agriculture professionals in agriculture and allied sectors.

P.S.O.4. Develop operational resources for the efficient and cost effective implementation of agriculture education.

7. ADMISSION TO THE COURSE:

1. Admission to the above course shall be made on the terms & conditions as prescribed in Ordinance of IIMT University, Meerut as amended from time to time.
2. The admission policy and procedure shall be decided from time to time by the Board of Studies (BoS) of the University based on the guidelines issued by the UGC/NEP/AICTE and Ministry of Education (MoE), Government of India. Seats are also made for Non-Resident Indians and foreign nationals, who satisfy the admission eligibility norms of the University. The number of seats in each of the M. Sc. Agriculture degree program will be decided by the University as per the directives of AICTE/ UGC / MOE, Government of India, considering the market demands.

7.1 Selection of candidates for admission:

The candidates shall be selected for admission to the above course on the basis of their academic merit to be determined on the basis of marks obtained either in Entrance Examination conducted by IIMT University, or in the qualifying examination as decided by the University from time to time.

8. ELIGIBILITY IN ALL YEAR AS NEP (ENTRY & EXIT) AS PER NEHQF AND NSQF (IF APPLICABLE)

The candidate seeking admission to M.Sc. (Ag.) Agronomy course must have passed B.Sc.(Hons) in Agriculture/ Zoology, Biology and Chemistry (ZBC) groups and should have obtained at least 50% marks (As per UGC/GOI/Sate govt. Norms are applicable in case of candidate belonging to reserved category) in the qualifying examination.

Note: The age of the candidate shall be determined as per entry in the Matriculation/Secondary School Examination certificate or any other examination recognized equivalent thereto.

9. CURRICULUM:

The curriculum for Master of Science in Agronomy Degree Programme is designed to have minimum and maximum credits as per the evaluation scheme. Credits that are distributed across four 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 BASE CREDIT SYSTEM (CBCS)/LOCF/OBE):

Structure of the M.Sc. Agriculture (master Degree Programme): Master of Science in Agronomy/Horticulture/Soil Science/Plant Pathology/Genetics & Plant Breeding/Entomology Degree Programmes will have the 2 years curriculum and syllabus as approved by the respective Board of Studies and Academic Council of the University. The curriculum for Master of Sciences in all degree programmes is designed to have minimum and maximum credits as per the scheme of 80 credits that are distributed across four semesters of study for the award of degree.

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

1. Core Course-CC
2. Discipline Specific Elective-DSE
3. Generic Elective-GE
4. Ability Enhancement Compulsory Courses-AECC
5. Skill Enhancement Courses-SEC
6. Research Enhancement (Thesis)
7. Research Seminar for personality Enhancement

12. REGISTRATION FOR COURSE IN A SEMESTER:

- A student will be eligible for registration of courses only if he/she satisfies the regulation 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. 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 of minimum and maximum.
- 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

13.1 Condonation of medical cases: For medical cases, submission of complete medical history and records with prior information from the parent / guardian to Dean (Students Welfare) DSW is mandatory and put-up recommendations to the Vice – Chancellor. Such condonation is permitted only twice for a student in the entire duration of the programme.

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. The Vice-Chancellor, based on the recommendation of Dean 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%.

13.3 Attendance Shortage Warning: Attendance shortage warning will be displayed on the Faculty's Notice Board and University Website by 10th day of every month.

13.4 Attendance Requirements/Eligibility to Appear in Examination:

- a) The student shall fulfil the following criteria to be eligible for appearing in the end term examinations:
- b) He/ she should bear a good moral character.
- c) He/she should be on the rolls of the University during the Semester.
- d) He/she should have not less than 75% of the attendance during the respective semester. The Dean of the Faculty on his own or on the recommendation of the HOD will have the power to give relaxation up to 5% on genuine grounds over the minimum 75% attendance requirement.
- e) Further, the Vice Chancellor on his own or on the recommendation of the Dean will have the power to give further relaxation up to 5% on genuine grounds over the above relaxation given by the Dean.
- f) He/she should not be a defaulter in payment of tuition fees or any other dues of the University and no disciplinary action is pending against him/her

13.5 Detained Students:

A student, who does not fulfil the criteria prescribed in Clauses 11, subject to clause 12, will not be eligible for appearing in the End Term Semester Examination in that particular paper and will be deemed as “Detained” in the paper. Such student will repeat the course/paper along with the regular students of the subsequent batch after fulfilling the prescribed conditions to appear in the “End Term” examination of the course/ paper.

14. ASSESSMENT PROCEDURE

The Committee recommends Uniform Grading system to be followed with uniform OGPA requirements for award of degrees at all levels and uniform conversion formulae to be followed for declaration of I, II and III divisions, distinctions *etc.* Declaration of division in the degree certificate to be made compulsory by all universities.

14.1 Examination marks distributions: External theory (50%) and Internal Theory (30%) + Practical (20%).

14.2 Courses with Theory and Practical: Mid-term Exam (30%) + Practical (20%) and External theory (50%)

14.3 Courses with only Theory: Mid-term Exam (40%) + Assignment (10%).

14.4 Courses with only Practical: 100% Internal.

15. Research Thesis/Semester Thesis Assessment Criteria- 60 % mark given by Thesis Writing + 40 % mark given by Viva –Voce.

16. Internship – Research / Industrial Internship.

17. For non – credit courses / audit courses – The Assessment will be done based on the respective assessment as per rubrics approved by Board of Studies (BOS). 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 credit

Two Hour Practical 1 credit

19. MAXIMUM DURATION OF PROGRAMME/PROMOTION POLICY

The duration of M.Sc.(Ag.) Agronomy course shall be of two academic years. Each year shall be divided into two semesters. Thus, the course shall comprise of four semesters will spread over two years. On completion of all the four semesters, the student will be awarded the degree. The student shall complete all the Four (4) semesters within a maximum period of 2 (Two) years from the date of admission to the first semester. However, he/she may be given one more year by the Academic Council under special circumstances which will be duly recorded in the Council’s resolution.

20. Maximum gaps between semester/year

As per UGC norms

21. Credit system & grading CGPA/SGPA:

IIMT-University implemented the UGC guidelines for implementation 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.

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: The school follows 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.

Table 3: Grading system

Letter Grade	Range
A+	$TM > M + 1.75SD$
A	$M + 1.25 SD \leq TM < M + 1.75SD$
B+	$M + 0.75 SD \leq TM < M + 1.25SD$
B	$M + 0.25 SD \leq TM < M + 0.75 SD$
C+	$M - 0.25 SD \leq TM < M - 0.25 SD$
C	$M - 0.75 SD \leq TM < M - 0.25 SD$
D+	$M - 1.25 SD \leq TM < M - 0.75 SD$
D	$M - 1.75 SD \leq TM < M - 1.25 SD$
E+	$M - 2.0 SD \leq TM < M - 1.75 SD$
E	$M - 2.25 SD \leq TM < M - 2.0 SD$

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.

Letter grades may be improved based on the following scheme: Use the table above to determine grade boundaries. Look for natural gaps in the neighbourhood of grade boundaries. Choose the largest gap in the neighbourhood 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,

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

- The ranges of marks once computed for awarding letter grades the first time, called the First Distribution (FD), will not be modified.
- If a re-evaluation leads to a change in marks, then FD will be used to award an appropriate letter grade.
- A retest may be permitted if
 - 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.
 - 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 C_i of course “i” and the grade points P_i earned for that course taken over all courses “i” registered and successfully completed by the student to the sum of C_i 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.

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.

A course successfully completed cannot be repeated

22. CLASS/DIVISION

Classification is based on CGPA and is as follows:

CGPA (with equivalent % marks)	Classification of Performance
CGPA of 9.0 (90 and above) or more in first attempt	Outstanding
CGPA of 8.0 (80 and above but less than 90) or more but less than 9.0	Excellent
CGPA of 7.0 (70 and above but less than 80) or more but less than 8.0	1 st Div. with Distinction
CGPA of 6.0 (60 and above but less than 70) or more but less than 7.0	1 st Division
CGPA above 5.0 Pass Grade (Above 50 but less than 60) but less than 6.0	2 nd Division
CGPA equal to 5.0 Pass Grade (50% marks)	Pass
CGPA less than Pass Grade (less than 50% marks)	Fail

- 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.
- 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 2 years for M.Sc. Agronomy.

23. TRANSFER OF CREDITS/ACADEMIC CREDIT BANK: 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 fulfilment of a degree program.

- 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 fulfilment of a degree

- program.
- b. The Academic Bank of Credits (ABC) has been envisaged to facilitate the academic mobility of students with the freedom to study across the Higher Education Institutions in the country with an appropriate "credit transfer" mechanism from one programme to another, leading to attain a Degree/ Diploma/PG-diploma, etc.
 - c. 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.
 - e. Students who have completed coursework, at least first year, at some university other than the university to which transfer is 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.

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

- 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.

23.1 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 by Head of the department. The moderation will not be restricted to just assessment but also include moderation of content and assessment design.

24. CHANGE OF 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.

25. USE OF TECHNOLOGICAL INTERVENTION

The use of educational technology and information communication technologies (ICTs) in education is the need of the hour. 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. Open-source learning systems 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 content.

26. STUDENT DISCIPLINE

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

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

29. POWER TO MODIFY

Notwithstanding 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: As per NEP

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.

32. ANY OTHER HEADING AS PER YOUR PROGRAM

- Common Academic Regulations for PG
- Credit requirements
- Framework of the courses:
- Course Title with Credit Load.

- Evaluation Scheme- **Annexure-A**
- Course Contents of M.Sc. in Agronomy/Horticulture/Soil Science/Plant Pathology/Genetics & Plant Breeding/Entomology

Common Academic Regulations for PG

Mandatory requirement of seminars

- It has been agreed to have mandatory seminars one in Masters (One Credit) and two in Doctoral programmes (two Credits).
- The students should be encouraged to make presentations on the latest developments and literature in the area of research topic. This will provide training to the students on preparation for seminar, organizing the work, critical analysis of data and presentation skills.

Residential requirements:

- The minimum and maximum duration of residential requirement for Masters'

P.G. Degree Programmes	Duration of Minimum	Residential Requirement Maximum
Masters' Degree	2 Academic Years (4 Semesters)	5 Academic Years (10 Semesters)
*Student may be allowed to discontinue temporarily only after completion of course work		

In case a student fails to complete the degree programme within the maximum duration of residential requirement, his/ her admission shall stand cancelled. The requirement shall be treated as satisfactory in the cases in which a student submits his/ her thesis any time during the 4th and 6th semester of his/ her resident ship at the University for Masters' and Ph.D. programme, respectively.

Evaluation of course work and comprehensive examination:

- For M.Sc., multiple levels of evaluation (First Test, Midterm and Final semester) is desirable. However, it has been felt that the comprehensive examination is redundant for M.Sc. students.

Advisory System:

Advisory Committee

- There shall be an Advisory Committee for every student consisting of not fewer than three members in the case of a candidate for Masters' degree with the Advisor as Chairperson. The Advisory Committee should have representatives from the major and minor fields amongst the members of the Post-graduate faculty accredited for appropriate P.G. level research. However, in those departments where qualified staff exists but due to unavoidable reasons Post-graduate degree programmes do not exist, the staff having Post-graduate teaching experience of two years or more may be included in the Advisory Committee as member representing the minor.
- At any given time, a P.G. teacher shall not be a Chairperson, Advisory Committee (including Master's programmes) for more than five students.
- The Advisor should convene a meeting of the Advisory Committee at least once in a

Semester. The summary record should be communicated to the Head of Department, Dean of the College of concerned, Director (Education)/ Dean PGS and Registrar for information.

Advisor/ Co-guide/ Member, Advisory Committee from other collaborating University/Institute/ Organization:

- In order to promote quality Post-graduate research and training in cutting edge areas, the University may enter into Memorandum of Understanding (MOU) with other Universities/Institutions for conducting research. While constituting an Advisory Committee of a student, if the Chairperson, Advisory Committee feels the requirement of involving of a faculty member/scientist of such partnering university/ Institute/ Organization, he/she may send a proposal to this effect to Director (Education)/Dean PGS along with the proposal for consideration of Student's Advisory Committee (SAC).
- The proposed faculty member from the partnering institution can be allowed to act as Chairperson/ Co-guide/ Member, SAC, by mutual consent, primarily on the basis of intellectual input and time devoted for carrying out the research work at the particular institution. The faculty member/ scientist of partnering institutions in the SAC shall become a temporary faculty member of the University by following the procedure approved by the Academic Council.

Allotment of students to the retiring persons:

Normally, retiring person may not be allotted M. Sc. Student if he/she is left with less than 2 years of service student if left with less than 3 years of service. However, in special circumstances, permission may be obtained from the Director (Education) / Dean PGS, after due recommendation by the concerned Dean Agriculture/Head of the Department.

Changes in the Advisory Committee:

- (i) Change of the Chairperson or any member of the Advisory Committee is not ordinarily permissible. However, in exceptional cases, the change may be effected with due approval of the Dean Agriculture/Dean PGS/Director Education.
- (ii) Normally, staff members of the university on extraordinary leave or on study leave or who leave the University service will cease to continue to serve as advisors of the Post-graduate students of the University. However, the Director (Education)/Dean PGS may permit them to continue to serve as advisor subject to the following conditions:
 - The concerned staff member must be resident in India and if he/she agrees to guide research and must be available for occasional consultations;
 - An application is made by the student concerned duly supported by the Advisory Committee;
 - The Head of the Department and the Dean of the College concerned agree to the proposal;
 - The staff member, after leaving the University service is granted the status of honorary faculty's membership by the Vice-Chancellor on the recommendation of the Director (Education)/Dean Agriculture/Dean PGS for guiding as Chairperson or Member, Advisory Committee the thesis/theses of the student(s) concerned only.
- (iii) In case the Chairperson/member of a Student's Advisory Committee retires, he/ she

- shall be allowed to continue provided that the student has completed his course work and minimum of 10 research credits and the retiring Chairperson/ member stays at the Headquarters of the College, till the thesis is submitted.
- (iv) If the Chairperson/ member proceeds on deputation to another organization, he/ she may be permitted to guide the student provided his/ her new organization is at the Headquarters of the College and his/ her organization is willing for the same.
 - (v) The change shall be communicated to all concerned by the Head of Department.

Prevention of plagiarism

- An institutional mechanism should be in place to check the plagiarism. The students must be made aware that manipulation of the data/ plagiarism is punishable with serious consequences.

Credit requirements

The following nomenclature and Credit Hrs need to be followed while providing the Syllabus for all the disciplines:

Name of the Courses	Masters' Programme
Major courses	20
Minor courses	08
Supporting courses	06
Common courses	05
Seminar	01
Thesis Research	40
Total	80

- **Major courses:** From the Discipline in which a student takes admission. Among the listed courses, the core courses compulsorily to be taken may be given mark
- **Minor courses:** From the subjects closely related to a student's major subject
- **Supporting courses:** The subject not related to the major subject. It could be any subject considered relevant for student's research work (such as Statistical Methods, Design of Experiments, etc.) or necessary for building his/her overall competence.
- **Common Courses:** The following courses (one credit each) will be offered to all students undergoing Master's degree programme:
 1. Library and Information Services
 2. Technical Writing and Communications Skills
 3. Intellectual Property and it management in Agriculture
 4. Basic Concepts in Laboratory Techniques
 5. Agricultural Research, Research Ethics and Rural Development Programmes

Some of these courses are already in the form of e-courses/ MOOCs. The students may be allowed to register the courses /similar courses on these aspects, if available online on SWAYAM or any other platform. If a student has already completed any of these courses during UG, he/she may be permitted to register for other related courses with the prior approval of the Head of Department (HoD)/Board of Studies (BoS).

M. Sc (Ag) Agronomy

Major Courses

Course Code	Course Title	Credit Hours
AGRON 501	Modern Concepts in Crop Production	3+0
AGRON 502	Principles and practices of soil fertility and Nutrient management	2+1
AGRON 503	Principles and Practices of Weed Management	2+1
AGRON 504	Principles and Practices of Water Management	2+1
AGRON 505	Agro Meteorology and Crop Weather Forecasting	1+1
AGRON 506	Agronomy of major Cereals and Pulses	2+1
AGRON 507	Agronomy of oilseed, fibre and sugar crops	2+1
AGRON 508	Conservation Agriculture	2+1
AGRON 509	Agronomy of fodder and forage crops	2+1
AGRON 510	Agrostology and Agroforestry	2+1
AGRON 511	Cropping System and Sustainable Agriculture	2+0
AGRON 512	Dryland Farming and Watershed Management	2+1
AGRON 513	Principles and practices of organic farming	2+1
AGRON 550	Master's Seminar	1+0
AGRON 560	Master's research	30

Minor Courses

Course Code	Course Title	Credit Hours
SOILS 502	Soil Fertility and Fertilizer Use	2+1
SOILS 509	Remote Sensing and GIS Technique for Soil and Crop Studies	2+1
SOILS 510	Analytical Techniques and Instrumental Methods in Soil and Plant Analysis	0+2
SOILS 511	Management of Problematic Soils and Waters	2+1
SOILS 513	Soil Survey and Land Use Planning	2+0
SOILS 514	Introduction to Nano Technology	1+0

M. Sc. (Horti.) in Fruit Science

Major courses: From the Discipline in which a student takes admission. Among the listed courses, the core courses compulsorily to be taken may be given *mark.

Course Code	Course Title	Credit Hours
FSC501*	Tropical Fruit Production	2+1
FSC502*	Sub-Tropical and Temperate Fruit Production	2+1
FSC503*	Propagation and Nursery Management of Fruit Crops	2+1
FSC504*	Breeding of Fruit Crops	2+1
FSC505	Systematics of Fruit Crops	2+1
FSC506	Canopy Management in Fruit Crops	1+1
FSC507	Growth and Development of Fruit Crops	2+1
FSC508	Nutrition of Fruit Crops	2+1

FSC509	Biotechnology of Fruit Crops	2+1
FSC 510	Organic Fruit Culture	2+1
FSC511	Export Oriented Fruit Production	2+1
FSC512	Climate Change and Fruit Crops	1+0
FSC513	Minor Fruit Production	2+1
FSC591	Seminar	0+1
FSC599	Research	0+30

Minor Courses: From the subjects closely related to a student's major subject.

Course Code	Course Title	Credit Hours
VSC 501	Production of Cool Season Vegetable Crops	2+1
VSC 502	Production Technology of Warm Season Vegetable Crops	2+1
VSC 503	Breeding of Vegetable Crops	2+1
VSC 504	Principles of Vegetable Breeding	3+0
VSC 505	Breeding of Self Pollinated Vegetable Crops	2+1
VSC 506	Breeding of Cross Pollinated Vegetable Crops	2+1
VSC 507	Protected Cultivation of Vegetable Crops	1+1
VSC 508	Seed Production Technology of Vegetable Crops	2+1
VSC 509	Production of Underutilized Vegetable Crops	2+1
VSC 510	Systematics of Vegetable Crops	1+1
VSC 511	Organic Vegetable Production	1+1
VSC 512	Production of Spice Crops	2+1
VSC 513	Processing of Vegetable	1+1
VSC 514	Postharvest Management of Vegetable Crops	2+1
SOILS 510	Analytical Technique and Instrumental Methods in Soil And Plant Analysis	(0+2)

M. Sc. (Ag.) in Entomology

Major courses: Discipline in which a student takes admission. Among the listed courses, the core courses compulsorily to be taken may be given *mark.

Course Code	Course Title	Credit Hours
ENT 501*	Insect Morphology	3 (2+1)
ENT 502*	Insect Anatomy and Physiology	3 (2+1)
ENT 503*	Insect Taxonomy	3 (1+2)
ENT 504*	Insect Ecology	3 (2+1)
ENT 505*	Biological Control of Insect Pests and Weeds	3 (2+1)
ENT 506*	Toxicology of Insecticides	3 (2+1)
ENT 507	Host Plant Resistance	2 (1+1)
ENT 508*	Concepts of Integrated Pest Management	2 (2+0)
ENT 509*	Pests of Field Crops	3 (2+1)

ENT 510*	Pests of Horticultural and Plantation Crops	3 (2+1)
ENT 511*	Post-Harvest Entomology	2 (1+1)
ENT 512	Insect Vectors of Plant Pathogens	2 (1+1)
ENT 513	Principles of Acarology	2 (1+1)
ENT 514	Vertebrate Pest Management	2 (1+1)
ENT 515	Techniques in Plant Protection	1 (0+1)
ENT 516	Apiculture	3 (2+1)
ENT 517	Sericulture	3 (2+1)
ENT 518	Lac Culture	3 (2+1)
ENT 519	Molecular Approaches in Entomology	3 (2+1)
ENT 520	Plant Quarantine, Biosafety and Biosecurity	2 (2+0)
ENT 521	Edible and Therapeutic Insects	2 (1+1)
ENT 522	Medical and Veterinary Entomology	2 (1+1)
ENT 523	Forest Entomology	2 (1+1)
ENT 591	Master's Seminar	1 (0+1)
ENT 599	Master's Research	30 (0+30)

*Compulsory Major Courses

Minor courses: From the subjects closely related to a student's major subject.

Course Code	Course Title	Credit Hours
PL PATH 505	Principles of Plant Pathology	2+1
PL PATH 507	Principles of Plant Disease Management	2+1
PL PATH 511	Chemicals and Botanicals in Plant Disease Management	2+1
PL PATH 514	Integrated Disease Management	2+1
PL PATH 515	Diseases of Field and Medicinal Crops	2+1

M.Sc. (Ag) Genetics and Plant Breeding (GPB)

Major Course: Discipline in which a student takes admission. Among the listed courses, the core courses compulsorily to be taken may be given *mark.

CODE	COURSE TITLE	CREDITS
GPB 501*	Principles of Genetics	3 (2+1)
GPB 502*	Principles of Plant Breeding	3 (2+1)
GPB 503*	Fundamentals of Quantitative Genetics	3 (2+1)
GPB 504	Varietal Development and Maintenance Breeding	2 (1+1)
GPB 505	Principles of Cytogenetics	3 (2+1)
GPB 506*	Molecular Breeding and Bioinformatics	3 (2+1)
GPB 507	Breeding for Quality and Special Traits	3 (2+1)
GPB 508	Mutagenesis and Mutation Breeding	3 (2+1)
GPB 509	Hybrid Breeding	3 (2+1)
GPB 510	Seed Production and Certification	2 (1+1)

GPB 511	Crop Breeding-I (<i>Kharif</i> Crops)	3 (2+1)
GPB 512	Crop Breeding-II (<i>Rabi</i> Crops)	3 (2+1)
GPB 513	Breeding Vegetable Crops	3 (2+1)
GPB 514	Breeding Fruit Crops	3 (2+1)
GPB 515	Breeding Ornamental Crops	3 (2+1)
GPB 516	Breeding for Stress Resistance and Climate Change	3 (2+1)
GPB 517	Germplasm Characterization and Evaluation	2 (1+1)
GPB 518	Genetic enhancement for PGR Utilization	2 (1+1)
*Compulsory Courses		

M.Sc. (Ag) in Plant Pathology

Major Course: Discipline in which a student takes admission. Among the listed courses, the core courses compulsorily to be taken may be given *mark.

Course Code	Course Title	Credits
PL PATH 501*	Mycology	2+1
PL PATH 502*	Plant Virology	2+1
PL PATH 503*	Plant Pathogenic Prokaryotes	2+1
PL PATH 504*	Plant Nematology	2+1
PL PATH 505*	Principles of Plant Pathology	2+1
PL PATH 506*	Techniques in Detection and Diagnosis of Plant Diseases	0+2
PL PATH 507	Principles of Plant Disease Management	2+1
PL PATH 508	Epidemiology and Forecasting of Plant Diseases	1+0
PL PATH 509	Disease Resistance in Plants	2+0
PL PATH 510	Ecology of Soil-borne Plant Pathogens	1+1
PL PATH 511	Chemicals and Botanicals in Plant Disease Management	2+1
PL PATH 512	Detection and Management of Seed Borne Pathogens	2+1
PL PATH 513	Biological Control of Plant Diseases	1+1
PL PATH 514	Integrated Disease Management	2+1
PL PATH 515*	Diseases of Field and Medicinal Crops	2+1
PL PATH 516	Diseases of Fruits, Plantation and Ornamental Crops	2+1
PL PATH 517	Diseases of Vegetable and Spices Crops	2+1
PL PATH 518	Post Harvest Diseases	2+1
PL PATH 519	Plant Quarantine and Regulatory Measures	1+0
PL PATH 591	Master's Seminar	0+1
PL PATH 521	Master's Research	0+40

M.Sc. in Soil Science

Major Course: Discipline in which a student takes admission. Among the listed courses, the core courses compulsorily to be taken may be given *mark.

CODE	COURSE TITLE	CREDITS
SOILS 501*	SOIL PHYSICS	2+1
SOILS 502*	SOIL FERTILITY AND FERTILIZER USE	3+1
SOILS 503*	SOIL CHEMISTRY	2+1
SOILS 504*	SOIL MINERALOGY, GENESIS, CLASSIFICATION AND SURVEY	2+1
SOILS 505	SOIL EROSION AND CONSERVATION	2+1
SOILS 506*	SOIL BIOLOGY AND BIOCHEMISTRY	2+1
SOILS 507	RADIOISOTOPES IN SOIL AND PLANT STUDIES	1+1
SOILS 508	SOIL, WATER AND AIR POLLUTION	2+1
SOILS 509	REMOTE SENSING AND GIS TECHNIQUES FOR SOIL AND CROP STUDIES	2+1
SOILS 510	ANALYTICAL TECHNIQUES AND INSTRUMENTAL METHODS IN SOIL AND PLANT ANALYSIS	0+2
SOILS 511	MANAGEMENT OF PROBLEMATIC SOILS AND WATERS	1+1
SOILS 512	LAND DEGRADATION AND RESTORATION	1+0
SOILS 513	SOIL SURVEY AND LAND USE PLANNING	2+0
SOILS 514	INTRODUCTION TO NANOTECHNOLOGY	2+1
SOILS 591	MASTER'S SEMINAR	1+0
SOILS 599	MASTER'S RESEARCH	30

**Indicates Core Courses which are Compulsory for Master Programme*

Supporting Courses: The following courses are being offered by various disciplines (The list is only indicative). Based on the requirement, any of the following courses may be opted under the supporting courses. The syllabi of these courses are available in the respective disciplines. If required, the contents may be modified to suit the individual discipline with approval of the concerned BoS:

Code	Course Title	Credit Hours
STAT-501	Mathematics for Applied Sciences	2+0
STAT-502	Statistical Methods for Applied Sciences	3+1
STAT-511	Experimental Designs	2+1
STAT-512	Basic Sampling Techniques	2+1
STAT-521	Applied Regression Analysis	2+1
STAT-522	Data Analysis Using Statistical Packages	2+1
MCA-501	Computers Fundamentals and Programming	2+1
MCA-502	Computer Organization and Architecture	2+0
MCA-511	Introduction to Communication Technologies, Computer Networking and Internet	1+1
MCA-512	Information Technology in Agriculture	2+1
AGM-508	Principles Of Remote Sensing And Its Applications In Agriculture	2+1

Common Courses: The following courses (one credit each) will be offered to all students undergoing Master's degree programme:

Code	Course Title	Credit

		Hours
PGS 501	Library and Information Services	0+1
PGS 502	Technical Writing and Communications Skills	0+1
PGS 503	Intellectual Property and its management in Agriculture	1+0
PGS 504	Basic Concepts in Laboratory Techniques	0+1
PGS 505	Agricultural Research, Research Ethics and Rural Development Programmes	1+0
PGS 506	(e course) Disaster Management	1+0



Evaluation Scheme

M. Sc (Ag.) Entomology

Year: I / Semester: I

S. No.	Sub. Code	Subject	Credits	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	ENT-501	Insect Morphology	3	2	1	50	20	30	60	100
2	ENT-502	Insect Anatomy and Physiology	3	2	1	50	20	30	60	100
3	ENT-503	Insect Taxonomy	3	1	2	50	20	30	60	100
4	ENT-510	Pests of Horticultural and Plantation Crops	3	2	1	50	20	30	60	100
5	STAT-502	Statistical Methods for Applied Sciences	4	3	1	50	20	30	60	100
6	MCA-511	Introduction to Networking and Internet Applications	2	1	1	50	20	30	60	100
7	PGS-501	Library and Information Services	1	0	1	0	100	0	60	100
8	PGS-503	(e-Course) Intellectual Property and its management in Agriculture	1	1	0	70	0	30	60	100
Total			20	12	8	370	220	210	480	800

Year: I / Semester: II

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	ENT-504	Insect Ecology	3	2	1	50	20	30	60	100
2	ENT-505	Biological Control of Insect Pests and Weeds	3	2	1	50	20	30	60	100
3	ENT-506	Toxicology of Insecticides	3	2	1	50	20	30	60	100

NAAC Accredited with A GRADE

4	ENT-508	Concepts of Integrated Pest Management	2	2	0	70	0	30	60	100
5	ENT-509	Pests of Field Crops	3	2	1	50	20	30	60	100
6	PL.PATH-505	Principles of Plant Pathology	3	2	1	50	20	30	60	100
7	PGS-502	Technical Writing and Communications Skills	1	0	1	0	100	0	60	100
8	ENT-591	Master's Seminar	1	0	1	0	100	0	60	100
9	ENT-599	Master's Research	10	0	0	0	0	0	0	0
Total			29	12	7	320	300	180	480	800

Year: II / Semester: III

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	ENT-511	Post-Harvest Entomology	2	1	1	50	20	30	60	100
2	PL.PATH-515	Diseases of Field and Medicinal Crops	3	2	1	50	20	30	60	100
3	PL.PATH-507	Principles of Plant Disease Management	3	2	1	50	20	30	60	100
4	ENT-512	Insect Vectors of Plant Pathogens	2	1	1	50	20	30	60	100
5	ENT-514	Vertebrate Pest Management	2	1	1	50	20	30	60	100
6	PGS-504	(e-Course) Basic Concepts in Laboratory Techniques	1	0	1	0	100	0	60	100
7	PGS-505	(e-Course) Agricultural Research, Research Ethics and Rural	1	1	0	70	0	30	60	100

		Development Programmes								
8	ENT-599	Master's Research	10	0	0	0	0	0	0	0
Total			24	8	6	320	200	180	420	700

Year: II / Semester: IV

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	ENT-599	Master's Research	20	0	0	100	0	0	60	100
Total			20							100

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: I
Class: M.Sc. (Ag.) Entomology		Semester: I
Credits: 3		Subject: Entomology
Theory: 2		
Practical: 1		
Course Code: ENT-501		Title: Insect Morphology
Course Objectives:		
1. Understand the structure and function of insect anatomical systems.		
2. Apply morphological knowledge in insect classification and identification.		
3. To develop the ability to recognize and interpret major morphological features of insects.		
4. To explore the functional adaptations of insect morphology in relation to ecological and behavioral roles.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2		
T: 00		
P: 02 (In Hours/Week)		
Theory - 1 Hr. = 1 Credit		
Practical- 2 Hrs.=1 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	External Morphology: Insect body wall structure, cuticular outgrowths, colouration and special integumentary structures in insects, body tagmata, sclerites and segmentation. Head- Origin, structure and modification; mouthparts, antennae, their types and functioning; tentorium and neck sclerites.	6
II	Thorax- Areas and sutures of tergum, sternum and pleuron, pterothorax; wings: structure and modifications, venation, wing coupling apparatus and mechanism of flight; legs: structure and modifications. Abdomen- Segmentation and appendages; genitalia and their modifications; embryonic and post-embryonic development.	6
III	Insect sense organs (mechano-, photo- and chemo- receptors); organogenesis at pupal stage; insect defence; chaetotaxy; morphological traits in relation to forensic entomology.	6
IV	Types of immature stages in insect orders, morphology of egg, nymph/ larva and pupa, identification of different immature stages of crop pests and stored product insects.	6
V	Comparative study of life history strategies in hemi-metabola and holometabola, immature stages as ecological and evolutionary adaptations, significance of immature stages for pest management.	6

Practical

Preparation of permanent mounts of different body parts and their appendages of taxonomic importance including male and female genitalia; Dissection of genitalia. Types of immature stages in insects; their collection, rearing and preservation;

Identification of immature insects to orders and families, in endopterygote orders, viz., Diptera, Lepidoptera, Hymenoptera and Coleoptera using key;

Suggested Reading

1. Chapman RF. 1998. The Insects: Structure and Function. Cambridge Univ. Press, Cambridge. Chu HF. 1992. How to Know Immature Insects. William Brown Publication, Iowa.
2. Duntson PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publishers, New Delhi.
3. Evans JW. 2004. Outlines of Agricultural Entomology. Asiatic Publ., New Delhi. Gillott C. 1995. Entomology, 2nd Ed. Plenum Press, New York, London.
4. Gullan PJ and Cranston PS. 2000. The Insects, An Outline of Entomology, 2nd Ed. Blackwell Science, UK.
5. Peterson A. 1962. Larvae of Insects. Ohio University Press, Ohio.
6. Richards OW and Davies RG. 1977. Imm's General Text Book of Entomology. 10th Ed. Chapman and Hall, London.
7. Snodgrass RE. 1993. Principles of Insect Morphology. Cornell Univ. Press, Ithaca.
8. Tembhore DB. 2000. Modern Entomology, Himalaya Publishing House, Mumbai. Stehr FW. 1998. Immature Insects. Vols. I, II. Kendall Hunt Publication, Iowa.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

1. Students will be able to accurately identify and describe the structural organization of external and internal anatomical features across diverse insect taxa.
2. Students will critically evaluate and compare morphological adaptations that enable insects to occupy a wide range of ecological niches and perform various life functions.
3. Students will demonstrate proficiency in the use of laboratory tools and techniques, including dissection and microscopy, for the examination and documentation of insect morphology.
4. Students will apply detailed morphological knowledge to the scientific classification and identification of insect specimens at various taxonomic levels.
5. Students will articulate the evolutionary and functional significance of specific morphological traits in relation to insect physiology, behavior, and environmental interactions.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: I
Class: M.Sc. (Ag.) Entomology		Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Entomology
Course Code: ENT-502		Title: Insect Anatomy and Physiology
Course Objectives: ● To understand the structural organization of insect anatomical systems. ● To examine the physiological mechanisms underlying insect function. ● To explore the relationship between insect structure, function, and environmental adaptation. ● To apply anatomical and physiological knowledge to insect classification and ecological interpretation.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 02 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Scope and importance of insect physiology; physiology of integument, moulting, chemistry of cuticle, biosynthesis of chitin; growth,	6
II	Hormonal control, metamorphosis and diapause; pheromone secretion, transmission, perception and reception.	6
III	Physiology and mechanism of digestion, circulation, respiration,	6
IV	Excretion, reproduction, secretion (exocrine and endocrine glands) and nerve impulse transmission in insects.	6
V	Importance of insect nutrition- role of vitamins, proteins, amino acids, carbohydrates, lipids, minerals and other food constituents; extra and intra-cellular microorganisms and their role in physiology; artificial diets.	6
Practical 1. Latest analytical techniques for analysis of free amino acids of haemolymph; 2. Determination of chitin in insect cuticle; 3. Examination and count of insect haemocytes; preparation and evaluation of various diets; Consumption, utilization and digestion of natural and artificial diets.		
Suggested Readings: 1. Chapman RF. 1998. Insects: Structure and Function. ELBS Ed., London. 2. Duntson PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publishers, New Delhi.		

3. Gullan PJ and Cranston PS. 2000. The Insects: An Outline of Entomology, 2nd Ed. Blackwell Science, UK.
4. Kerkut GA and Gilbert LI. 1985. Comprehensive Insect Physiology, Biochemistry and Pharmacology. Vols. I-XIII. Pergamon Press, New York.
5. Patnaik BD. 2002. Physiology of Insects. Dominant Publishers, New Delhi.
6. Richards OW and Davies RG. 1977. Imm's General Text Book of Entomology. 10th Ed. Vol. 1. Structure, Physiology and Development. Chapman and Hall, New York.
7. Simpson SJ. 2007. Advances in Insect Physiology, Vol. 33, Academic Press (Elsevier), London, UK.
8. Wigglesworth VB. 1984. Insect Physiology. 8th Ed. Chapman and Hall, New York.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
1. Students are expected to have a thorough understanding of insect growth and development, physiology of exoskeleton, endoskeleton and different organ systems; action and role of hormones, pheromones, physiology of nutrition and its application. 2. Students will be able to accurately describe the morphology and internal anatomy of insects, including the integumentary, digestive, circulatory, respiratory, excretory, nervous, endocrine, and reproductive systems. 3. Students will analyze and explain the physiological processes that govern insect survival, development, and behavior in diverse ecological contexts. 4. Students will demonstrate the ability to conduct anatomical dissections and use appropriate laboratory techniques to investigate insect body systems and functions.	

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: I
Class: M.Sc. (Ag.) Entomology		Semester: I
Credits: 3		Subject: Entomology
Theory: 1		
Practical: 2		
Course Code: ENT-503		Title: Insect Taxonomy
Course Objectives: 1. To understand the principles and rules of insect classification and nomenclature. 2. To study the diagnostic characteristics of major insect orders and families. 3. To develop skills in the identification and differentiation of insect taxa. 4. To explore the evolutionary relationships and phylogenetic frameworks of insects.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 1, Practical 2 = 3 Credits		
L: 1 T: 0 P: 02 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	History of insect classification; principles of systematics and its importance. Identification, purpose, methods character matrix, taxonomic keys. Descriptions subjects of descriptions, characters, nature of characters, analogy v/s homology, parallel v/s convergent evolution, intraspecific variation in characters, polythetic and polymorphic taxa, sexual dimorphism.	3
II	Brief evolutionary history of insects introduction to phylogeny of insects and Classification of Superclass Hexapoda Classes – Ellipura (Collembola, Protura), Diplura and Insecta- and the Orders contained. International Code of Zoological Nomenclature, Phylocode, its brief explanation and uses.	3
III	Process of speciation and interbreeding allopatric species. Molecular systematics, DNA barcoding, karyological and biochemical approaches in taxonomy. Insect labeling protocols and procedures. Distinguishing characters, general biology, habits and habitats of insect orders and economically important families contained in them. Collembola, Protura, Diplura.	3

IV	Class Insecta: Subclass Apterygota – Archaeognatha, Thysanura. Subclass: Pterygota, Division Palaeoptera – Odonata and Ephemeroptera. Division: Neoptera: Subdivision: Orthopteroid and Blattoid Orders (=Oligoneoptera: Plecoptera, Blattodea, Isoptera, Mantodea, Grylloblattodea, Dermaptera, Orthoptera, Phasmatodea, Mantophasmatodea, Embioptera, Zoraptera), Subdivision: Hemipteroid Orders (=Paraneoptera): Psocoptera, Phthiraptera, Thysanoptera and Hemiptera.	3
V	Distinguishing characters, general biology, habits and habitats of insect orders and economically important families contained in them (Continued). Division Neoptera Subdivision Endopterygota, Section Neuropteroid-Coleopteroid Orders: Strepsiptera, Megaloptera, Raphidioptera, Neuroptera and Coleoptera, Section Panorpid Orders Mecoptera, Siphonaptera, Diptera, Trichoptera, Lepidoptera, and Section Hymenopteroid Orders: Hymenoptera.	3

Practical

Study of Orders of insects and their identification using taxonomic keys; Keying out families of insects of different major Orders: Odonata, Orthoptera, Blattodea, Mantodea, Isoptera, Hemiptera, Thysanoptera, Phthiraptera, Neuroptera, Coleoptera, Diptera, Lepidoptera and Hymenoptera; Field visits to collect insects of different orders.

Suggested Readings:

1. CSIRO 1990. The Insects of Australia: A Text Book for Students and Researchers. 2nd Ed. Vols. I and II, CSIRO. Cornell Univ. Press, Ithaca.
2. Freeman S and Herron JC. 1998. Evolutionary Analysis. Prentice Hall, New Delhi. Gullan PJ and Cranston PS. 2010. The Insects: An outline of Entomology. 4th Ed. Wiley-Blackwell Publications, West Sussex, UK.
3. Mayr E. 1971. Principles of Systematic Zoology. Tata McGraw Hill, New Delhi. Richards OW and Davies RG. 1977. Imm's General Text Book of Entomology. 10th Ed. Chapman and Hall, London.
4. Ross HH. 1974. Biological Systematics. Addison Wesley Publ. Company.
5. Triplehorn CA and Johnson NF. 1998. Borror and DeLong's Introduction to the Study of Insects. 7th Ed. Thomson/ Brooks/ Cole, USA/ Australia.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations/Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

1. Students are expected to know the evolution of arthropods, especially insects and other hexapods, and their hierarchical classification
2. Acquire working skills for collecting, mounting, and preserving insects
3. Understand the basic concepts of taxonomic hierarchy, identification, taxonomic characters, variations, taxonomic keys and preparation of taxonomic papers
4. Identify insects of economic importance up to family levels, taking up the insect orders of agriculture and veterinary importance

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: I
Class: M.Sc. (Ag.) Entomology		Semester: I
Credits: 3		Subject: Entomology
Theory: 2		
Practical: 1		
Course Code: ENT-510		Title: Pests of Horticultural and Plantation Crops
Course Objectives: 1. To understand the biology, ecology, and behavior of pests affecting fruits, vegetables, spices, ornamentals, and plantation crops. 2. To assess the types and extent of pest-induced damage on horticultural produce. 3. To develop appropriate pest management strategies tailored to high-value crops.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 01 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Fruit Crops- mango, guava, banana, jack, papaya, pomegranate, litchi, grapes, ber, fig, citrus, aonla, pineapple, apple, peach and other temperate fruits.	6
II	Vegetable crops- tomato, potato, radish, carrot, beetroot, cole crops, French beans, chow-chow, brinjal, okra, all gourds, drumstick, leafy vegetables, etc.	6
III	Plantation crop- coffee, tea, rubber, coconut, arecanut, cashew, cocoa, etc.;	6
IV	Spices and Condiments- pepper, cardamom, clove, nutmeg, chillies, turmeric, ginger, beetlevine, etc.	6
V	Ornamental, medicinal and aromatic plants and pests in polyhouses/ protected cultivation.	6
Practical • Collection and identification of important pests and their natural enemies on different crops; • Study of life history of important insect pests and non-insect pests.		
Suggested Readings: 1. Atwal AS and Dhaliwal GS. 2002. Agricultural Pests of South Asia and their Management. Kalyani Publishers, New Delhi. 2. Butani DK and Jotwani MG. 1984. Insects and Vegetables. Periodical Expert Book Agency, New Delhi.		

3. Dhaliwal GS, Singh R and Chhillar BS. 2006. Essential of Agricultural Entomology. Kalyani Publishers, New Delhi.
4. Srivastava RP. 1997. Mango Insect Pest Management. International Book Distr., Dehra Dun.
5. Verma LR, Verma AK and Goutham DC. 2004. Pest Management in Horticulture Crops: Principles and Practices. Asiatech Publ., New Delhi.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
1. Students are expected to acquire knowledge of insect pests of horticultural, medicinal and plantation crops, their nature of damage, life history traits and effective management. 2. Students will assess the economic impact of pest infestations on crop yield, quality, and marketability, using established damage assessment and loss estimation techniques. 3. Students will evaluate and recommend context-specific pest management approaches, including the use of resistant varieties, biological control agents, biorational pesticides, and cultural practices for sustainable production.	

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: I
Class: M.Sc. (Ag.) Entomology		Semester: II
Credits: 3		Subject: Entomology
Theory: 2		
Practical: 1		
Course Code: ENT-504		Title: Insect Ecology
Course Objectives: 1. To examine the ecological roles and interactions of insects within ecosystems. 2. To understand the influence of environmental factors on insect populations and communities. 3. To explore insect behavior and life-history strategies in relation to ecological processes. 4. To apply ecological principles in the study and management of insect biodiversity.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 02 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	History and definition. Basic Concepts. Organisation of the Biological world. Plato’s Natural Balance vs Ecological Dynamics as the modern view. Abundance and diversity of insects, Estimates and Causal factors. Study of abundance and distribution and relation between the two. Basic principles of abiotic factors and their generalised action on insects.	8
II	Implications for abundance and distribution of organisms including insects- Law of the Minimum, Law of Tolerance, and biocoenosis, Systems approach to ecology. Basic concepts of abundance- Model vs Real world. Population growth basic models–Exponential vs Logistic models. Discrete vs Continuous growth models.	8
III	Concepts of Carrying capacity, Environmental Resistance and Optimal yield. Vital Statistics Life Tables and their application to insect biology. Survivorship curves. Case studies of insect life tables. Population dynamics- Factors affecting abundance Environmental factors, dispersal and migration, Seasonality in insects. Classification and mechanisms of achieving different seasonality- Diapause (Quiescence) aestivation, hibernation.	8

IV	Biotic factors- Food as a limiting factor for distribution and abundance, Nutritional Ecology. Food chain- web and ecological succession. Interspecific interactions- Basic factors governing the interspecific interactions- Classification of interspecific interactions – The argument of cost-benefit ratios. Competition- Lotka-Volterra model, Concept of niche ecological homologues, competitive exclusion. Evolution of mimicry, colouration, concept of predator satiation; evolution of life history strategies.	8
V	Community ecology- Concept of guild, Organisation of communities- Hutchinson Ratio, May's d/w, Relation between the two and their association with Dyar's Law and Przibram's law. Relative distribution of organisms, Concept of diversity- the Wallacian view. Assessment of diversity. Diversity- stability debate, relevance to pest management. Pest management as applied ecology. Climate change and insect pest/ natural enemy population; ecological engineering.	8

Practical

Types of distributions of organisms; Methods of sampling insects, estimation of densities of insects and understanding the distribution parameters- Measures of central tendencies, Poisson Distribution, Negative Binomial Distribution; Determination of optimal sample size. Learning to fit basic population growth models and testing the goodness of fit; Fitting Holling's Disc equation; Assessment of prey-predator densities from natural systems and understanding the correlation between the two; Assessing and describing niche of some insects of a single guild; Calculation of niche breadth, activity breadth and diagrammatic representation of niches of organisms; Calculation of diversity indices- Shannon's, Simpson's and Avalanche Index and understanding their associations and parameters that affect their values; Problem solving in ecology. Field visits to understand different ecosystems and to study insect occurrence in these systems.

Suggested Readings:

1. Begon M, Townsend CR and Harper JL. 2006. Ecology: From Individuals to Ecosystems. 4th Ed. Blackwell Publishing, USA/ UK/ Australia.
2. Chapman JL and Reiss MJ. 2006. Ecology: Principles and Applications. 2nd Ed. Cambridge Univ. Press, Cambridge.
3. Krebs CJ. 1998. Ecological Methodology. 2nd Ed. Benjamin-Cummings Publ. Co., New York.
4. Magurran AE. 1988. Ecological Diversity and its Measurement.
5. Princeton Univ. Press, Princeton. Price PW. 1997. Insect Ecology. 3rd Ed. John Wiley, New York.
6. Real LA and Brown JH. (Eds). 1991. Foundations of Ecology: Classic Papers with Commentaries. University of Chicago Press, Chicago.

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

Evaluation/Assessment Methodology	
	Max. Marks
4. Class tasks/ Sessional Examination	30
5. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
6. ESE	50
Total:	100

Course Learning Outcomes:

1. The students are expected to be well versed with the basic concepts of ecology, ecological succession, population ecology, community ecology, nutritional ecology and different insect-ecosystem interactions
2. Quantification of insect diversity and abundance, life table analyses, predator prey and host-parasitoid relations, functional and numerical responses, niche breadth and overlap.
3. Students will interpret insect behavioral ecology and life-history strategies, including foraging, mating, dispersal, and development, within an ecological and evolutionary framework.
4. Students will demonstrate the ability to design, conduct, and analyze ecological field studies involving insect sampling, population monitoring, and habitat assessment.
5. Students will integrate ecological knowledge to propose evidence-based strategies for insect conservation, habitat management, and the mitigation of anthropogenic impacts on insect diversity.

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.	Year: I	
Class: M.Sc. (Ag.) Entomology	Semester: II	
Credits: 3	Subject: Entomology	
Theory: 2		
Practical: 1		
Course Code: ENT-505	Title: Biological Control of Insect Pests And Weeds	
Course Objectives: 1. To understand the principles and types of biological control used against insect pests and weeds. 2. To study the biology and ecology of natural enemies used in biological control programs. 3. To evaluate the effectiveness and limitations of biological control strategies. 4. To apply biological control concepts in integrated pest and weed management systems.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 3 T: 1 P: 02 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	History, principles and scope of biological control; important groups of parasitoids, predators and pathogens; principles of classical biological control-importation, augmentation and conservation.	5
II	History of insect pathology, infection of insects by bacteria, fungi, viruses, protozoa, rickettsiae, spiroplasma and nematodes. Biology, adaptation, host seeking behaviour of predatory and parasitic groups of insects.	5
III	Role of insect pathogenic nematodes, viruses, bacteria, fungi, protozoa, etc., their mode of action. Biological control of weeds using insects. Epizootiology, symptomatology and etiology of diseases caused by the above and the factors controlling these.	5
IV	Defense mechanisms in insects against pathogens. Mass production of quality bio-control agents- techniques, formulations, economics, field release/ application and evaluation. Development of insectaries, their maintenance.	5
V	Successful biological control projects, analysis, trends and future possibilities of biological control. Importation of natural enemies-Quarantine regulations, biotechnology in biological control. Semio-chemicals in biological control.	5

Practical Identification of common natural enemies of crop pests (parasitoids, predators, microbes) and weed killers; Visits to bio-control laboratories to learn rearing and mass production of egg, egg larval, larval, larval-pupal and pupal parasitoids, common predators, microbes and their laboratory hosts, phytophagous natural enemies of weeds; Field collection of parasitoids and predators. Hands-on training in culturing, identification of common insect pathogens. Quality control and registration standards for biocontrol agents.

Suggested Readings:

1. Burges HD and Hussey NW. (Eds). 1971. Microbial Control of Insects and Mites. Academic Press, London.
2. De Bach P. 1964. Biological Control of Insect Pests and Weeds. Chapman and Hall, New York.
3. Dhaliwal GS and Arora R. 2001. Integrated Pest Management: Concepts and Approaches. Kalyani Publishers, New Delhi.
4. Gerson H and Smiley RL. 1990. Acarine Biocontrol Agents – An Illustrated Key and Manual. Chapman and Hall, New York.
5. Huffaker CB and Messenger PS. 1976. Theory and Practices of Biological Control. Academic Press, London.
6. Ignacimuthu SS and Jayaraj S. 2003. Biological Control of Insect Pests. Phoenix Publ., New Delhi.
7. Saxena AB. 2003. Biological Control of Insect Pests. Anmol Publ., New Delhi.
7. Van Driesche and Bellows TS. Jr. 1996. Biological Control. Chapman and Hall, New York.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

1. Students are expected to have a good understanding of the role of natural enemies in managing pest populations below those causing economic damage
2. Learn the techniques for mass production of quality bio-agents and their optimal use in IPM
3. Students will critically assess the characteristics, life cycles, and functional roles of parasitoids, predators, and pathogens in the suppression of pest populations and weed infestations.
4. Students will evaluate the advantages, risks, and non-target effects of biological control interventions within the context of sustainable agricultural and natural resource management systems.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.		Year: I
Class: M.Sc. (Ag.) Entomology		Semester: II
Credits: 3		Subject: Entomology
Theory: 2		
Practical: 1		
Course Code: ENT-506		Title: Toxicology of Insecticides
Course Objectives: 1. To orient the students with structure and mode of action of important insecticides belonging to different groups 2. To study the modes of action and physiological effects of insecticides on target and non-target organisms. 3. Development of resistance to insecticides by insects, environmental pollution caused by toxic insecticides and their toxicological aspects. 4. To evaluate insecticide resistance and its management in pest populations.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 1 P: 02 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Definition and scope of insecticide toxicology; history of chemical control; pesticide use and pesticide industry in India. Classification of insecticides and acaricides based on mode of entry, mode of action and chemical nature;	6
II	categorization of insecticides on the basis of toxicity – criteria for bees, beneficial insects and other insects in general; structure and mode of action of organochlorines, organophosphates, carbamates, pyrethroids, tertiary amines, neonicotinoids, oxadiazines, phenyl pyrozoles, insect growth regulators, microbials, botanicals, new promising compounds/ new insecticide molecules; nanopesticides; drawbacks of insecticide abuse.	6
III	Principles of toxicology; evaluation of insecticide toxicity; joint action of insecticides synergism, potentiation and antagonism; factors affecting toxicity of insecticides; insecticide compatibility, selectivity and phytotoxicity. bioassay definition, objectives, criteria, factors, problems and solutions.	6
IV	Insecticide metabolism; insect-pest resistance to insecticides; mechanisms and types of resistance; insecticide resistance management and pest resurgence.	6

V	Insecticide residues, their significance and environmental implications; procedures of insecticide residue analysis. Insecticide Act, registration procedures, label claim, and quality control of insecticides; safe use of insecticides; diagnosis and treatment of insecticide poisoning.	6
Practical 1. Insecticide formulations and mixtures; 2. Laboratory and field evaluation of bio-efficacy of insecticides; 3. Bioassay techniques; 4. Probit analysis; 5. Evaluation of insecticide toxicity; 6. Toxicity to beneficial insects; 7. Pesticide appliances; 8. Working out doses and concentrations of pesticides; 9. Procedures of residue analysis.		
Suggested Readings: 1. Chattopadhyay SB. 1985. Principles and Procedures of Plant Protection. Oxford and IBH, New Delhi. 2. Dodia DA, Petel IS and Petal GM. 2008. Botanical Pesticides for Pest Management. Scientific Publisher (India), Jodhpur. 3. Dovener RA, Mueninghoff JC and Volgar GC. 2002. Pesticides formulation and delivery systems: meeting the challenges of the current crop protection industry. ASTM, USA Gupta 4. HCL.1999. Insecticides: Toxicology and Uses. Agrotech Publ., Udaipur. Ishaaya I and Degheele (Eds.). 1998. Insecticides with Novel Modes of Action. Narosa Publ. House, New Delhi. 5. Ishaaya I and Degheele D. 1998. Insecticides with Novel Modes of Action: Mechanism and Application. Norosa Publishing House, New Delhi. 6. Krieger RI. 2001. Handbook of Pesticide Toxicology. Vol-II. Academic Press. Orlando Florida. 7. Mathews GA. 2002. Pesticide Application Methods. 4th Ed. Intercept. UK. 8. Matsumura F. 1985. Toxicology of Insecticides. Plenum Press, New York. 9. Otto D and Weber B. 1991. Insecticides: Mechanism of Action and Resistance. Intercept Ltd., UK. 10. Pedigo LP and Marlin ER. 2009. Entomology and Pest Management, 6th Edition, Pearson Education Inc., Upper Saddle River, New Jersey 07458, U.S.A. 11. Perry AS, Yamamoto I, Ishaaya I and Perry R. 1998. Insecticides in Agriculture and Environment. Narosa Publ. House, New Delhi. 12. Prakash A and Rao J. 1997. Botanical Pesticides in Agriculture. Lewis Publication, New York. 13. Roy NK. 2006. Chemistry of Pesticides. Asia Printograph Shahdara Delhi.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3. ESE		50
Total:		100

Course Learning Outcomes:

1. Students are expected understand the concept of toxicity, bio-efficacy, insecticide formulations, modes of action of insecticides, estimation of insecticide residues and have significant know-how about the functioning of various types of spray equipments.
2. Students will be able to explain the chemical structures, classifications, and physicochemical properties of various classes of insecticides and their relevance to toxicological behavior.
3. Students will analyze the mechanisms by which insecticides exert toxic effects at the cellular, biochemical, and physiological levels in insects and other organisms.

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: M.Sc. (Ag.) Entomology		Semester: II
Credits: 2		Subject: Entomology
Theory: 2		
Practical: 0		
Course Code: ENT-508		Title: Concepts of Integrated Pest Management
Course Objectives: 1. To understand the fundamental principles and philosophy of Integrated Pest Management. 2. To study the ecological and economic foundations of pest management decision-making. 3. To evaluate various pest control strategies and their integration within IPM programs. 4. To apply IPM principles in developing sustainable and environmentally responsible pest management systems.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 0, Practical 2 = 2 Credits		
L: 2 T: 1 P: 01 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	History, origin, definition and evolution of various terminologies. Importance of resistance, principles, classification, components, types and mechanisms of resistance. National and international level crop protection organizations; insecticide regulatory bodies; synthetic insecticide, bio-pesticide and pheromone registration procedures; label claim of pesticides – the pros and cons.	6
II	Concept and philosophy, ecological principles, economic threshold concept and economic consideration. Insect-host plant relationships; theories and basis of host plant selection in phytophagous insects. Tools of pest management and their integration- legislative, quarantine regulations, cultural, physical and mechanical methods; semio chemicals, biotechnological and bio-rational approaches in IPM.	6
III	Pest survey and surveillance, forecasting, types of surveys including remote sensing methods, factors affecting surveys; political, social and legal implications of IPM; pest risk analysis; pesticide risk analysis; cost benefit ratios and partial budgeting; case studies of successful IPM programmes.	6

IV	ITK-s in IPM, area-wide IPM and IPM for organic farming; components of ecological engineering with successful examples. Characterization of agro-ecosystems; sampling methods and factors affecting sampling; population estimation methods; crop loss assessment direct losses, indirect losses, potential losses, avoidable losses, unavoidable losses; global and Indian scenario of crop losses.	6
V	Computation of EIL and ETL; crop modeling; designing and implementing IPM system. Screening techniques; breeding for insect resistance in crop plants; exploitation of wild plant species; gene transfer, successful examples of resistant crop varieties in India and world.	6

Suggested Readings:

1. Dhaliwal GS and Arora R. 2003. Integrated Pest Management – Concepts and Approaches. Kalyani Publishers, New Delhi.
2. Horowitz AR and Ishaaya I. 2004. Insect Pest Management: Field and Protected Crops. Springer, New Delhi.
3. Ignacimuthu SS and Jayaraj S. 2007. Biotechnology and Insect Pest Management. Elite Publ., New Delhi.
4. Norris RF, Caswell-Chen EP and Kogan M. 2002. Concepts in Integrated Pest Management. Prentice Hall, New Delhi.
5. Pedigo RL. 2002. Entomology and Pest Management. 4th Ed. Prentice Hall, New Delhi.
6. Subramanyam B and Hagstrum DW. 1995. Integrated Management of Insects in Stored Products. Marcel Dekker, New York.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

1. Students are expected to have significant knowledge of IPM concepts, estimation of losses due to insect pests, computation of ETL, EIL and should be able take management decisions.
2. Students will be able to explain the core principles of Integrated Pest Management, including economic thresholds, monitoring techniques, and the integration of biological, cultural, mechanical, and chemical control methods.
3. Students will critically evaluate the ecological interactions among pests, natural enemies, crops, and environmental factors that influence pest population dynamics and management strategies.
4. Students will analyze the economic implications of pest management, including cost-benefit analysis, risk assessment, and the concept of economic injury levels for decision-making in IPM.

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: I
Class: M.Sc. (Ag.) Entomology		Semester: II
Credits: 3		Subject: Entomology
Theory: 2		
Practical: 1		
Course Code: ENT-509		Title: Pests of Field Crops
Course Objectives: 1. To identify major insect pests associated with important field crops. 2. To study the biology, behavior, and ecology of field crop pests. 3. To understand the nature and extent of crop damage caused by various pest species. 4. To explore effective pest monitoring, prevention, and management strategies.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 1 P: 01 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage,	6
II	seasonal abundance and management of insect and mite pests and vectors. Insect pest scenario in relation to climate change.	6
III	Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non-insect pests (mites, birds, rodents, snails, slugs, etc.).	6
IV	Insect pests of cereals and millets and their management. Insect pests of pulses, tobacco, oilseeds and their management.	6
V	Insect pests of fibre crops, forage crops, sugarcane and their management.	6
Practical 1. Field visits, collection and identification of important pests and their natural enemies; 2. Detection and estimation of infestation and losses in different crops; 3. Study of life history of important insect pests.		
Suggested Readings: 1. David, BV and Ramamurthy, VV. 2001. Elements of Economic Entomology. Popular Book Depot, Chennai. 2. Dhaliwal GS, Singh R and Chhillar BS. 2006. Essentials of Agricultural Entomology. Kalyani Publishers, New Delhi. 3. Dunston AP. 2007. The Insects: Beneficial and Harmful Aspects. Kalyani Publishers, New Delhi Evans JW. 2005. Insect Pests and their Control. Asiatic Publ., New Delhi.		

4. Nair MRGK. 1986. Insect and Mites of Crops in India. ICAR, New Delhi.
5. Prakash I and Mathur RP. 1987. Management of Rodent Pests. ICAR, New Delhi. Saxena RC and Srivastava RC. 2007. Entomology at a Glance. Agrotech Publ. Academy, Udaipur.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
1. Students are expected to acquire knowledge of insect pests of field crops, their nature of damage, life history traits and effective management. 2. Students will be able to accurately identify economically important insect pests of major field crops based on morphological characteristics and field symptoms. 3. Students will analyze the life cycles, feeding habits, reproductive strategies, and seasonal dynamics of key pest species in relation to crop phenology and environmental conditions. 4. Students will assess the direct and indirect damage caused by insect pests on field crops, including yield loss estimation and quality degradation, using both qualitative and quantitative methods.	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: II
Class: M.Sc. (Ag.) Entomology		Semester: III
Credits: 2		Subject: Entomology
Theory: 1		
Practical: 1		
Course Code: ENT-511		Title: Post Harvest Entomology
Course Objectives: 1. Understand the biology and behavior of insects that infest stored products. 2. Identify key storage pests and their damage symptoms in various post-harvest systems. 3. Study ecological and environmental factors influencing pest outbreaks post-harvest. 4. Learn various pest management strategies , including physical, chemical, and biological methods. 5. Evaluate modern technologies and IPM practices for effective post-harvest pest control.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 1, Practical 1 = 2 Credits		
L: 1 T: 1 P: 01 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction, history of storage entomology, concepts of storage entomology and significance of insect pests. Post-harvest losses in toto vis-à-vis total production of food grains in India. Scientific and socio-economic factors responsible for grain losses. Concept of seed vault. Important pests namely insects, mites, rodents, birds and microorganisms associated with stored grain and field conditions including agricultural products;	3
II	traditional storage structures; association of stored grain insects with fungi and mites, their systematic position, identification, distribution, host range, biology, nature and extent of damage, role of field and cross infestations and natural enemies, type of losses in stored grains and their effect on quality including biochemical changes. Ecology of insect pests of stored commodities/ grains with special emphasis on role of moisture, temperature and humidity in safe storage of food grains and commodities.	3
III	Stored grain deterioration process, physical and biochemical changes and consequences. Grain storage- types of storage structures i.e., traditional, improved and modern storage structures in current usage. Ideal seeds and commodities' storage conditions. Important rodent pests associated with stored grains and their non-chemical and chemical control including fumigation of rat burrows.	3

IV	Role of bird pests and their management. Control of infestation by insect pests, mites and microorganisms. Preventive measures-Hygiene/sanitation, disinfections of stores/ receptacles, legal methods. Curative measures-Non-chemical control measures- ecological, mechanical, physical, cultural, biological and engineering.	3
V	Chemical control prophylactic and curative-Characteristics of pesticides, their use and precautions in their handling with special emphasis on fumigants. Insecticide resistance in stored product pests and its management; recent advances (MAS, PPP, HS) in storage pest management; integrated approaches to stored grain pest management.	3
Practical 1. Collection, identification and familiarization with the stored grains/ seed insect pests and nature of damage caused by them; 2. Detection of hidden insect infestation in stored food grains; 3. Estimation of uric acid content in infested produce; estimation of losses in stored food grains; 4. Determination of moisture content in stored food grains; 5. Familiarization of storage structures, demonstration of preventive and curative measures including fumigation techniques; 6. Treatment of packing materials and their effect on seed quality; 7. Field visits to save grain campaign, central warehouse and FCI warehouses and institutions engaged in research or practice of grain storage like CFTRI, Mysore; IGSMRI, Hapur, etc. (only where logistically feasible).		
Suggested Readings: 1. Hall DW. 1970. Handling and Storage of Food Grains in Tropical and Subtropical Areas. FAO. Agricultural Development Paper No. 90 and FAO, Plant Production and Protection Series No. 19, FAO, Rome. 2. Jayas DV, White NDG and Muir WE. 1995. Stored Grain Ecosystem. Marcel Dekker, New York. 3. Khader V. 2004. Textbook on Food Storage and Preservation. Kalyani Publishers, New Delhi. 4. Khare BP. 1994. Stored Grain Pests and Their Management. Kalyani Publishers, New Delhi. 5. Subramanyam B and Hagstrum DW. 1995. Interrelated Management of Insects in Stored Products. Marcel Dekker, New York.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3. ESE		50
Total:		100
Course Learning Outcomes: 1. Students are expected to acquire knowledge of pestiferous insects, mites, rats and birds affecting stored produce, their nature of damage, life history traits and effective management. 2. Detection of insect infestation and familiarization with different storage structures. 3. Learning preventive and curative measures to manage infestation in storage houses.		

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: II
Class: M.Sc. (Ag.) Entomology		Semester: III
Credits: 2		Subject: Entomology
Theory: 1		
Practical: 1		
Course Code: ENT-512		Title: Insect Vectors of Plant Pathogens
Course Objectives: 1. Study the biology, ecology, and behavior of major insect vectors. 2. Explore the mechanisms of pathogen transmission, including persistent, non-persistent, and propagative modes. 3. Analyze vector-pathogen-host interactions in different cropping systems. 4. Evaluate vector management strategies to reduce the spread of plant diseases.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 1, Practical 1 = 2 Credits		
L: 1 T: 1 P: 01 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	History of developments in the area of insects as vectors of plant pathogens. Important insect vectors and their characteristics; mouth parts and feeding processes of important insect vectors. Efficiency of transmission.	3
II	Transmission of plant viruses and fungal pathogens. Relation between viruses and their vectors.	3
III	Transmission of plant viruses by aphids, whiteflies, mealy bugs and thrips.	3
IV	Transmission of mycoplasma and bacteria by leaf hoppers and plant hoppers.	3
V	Transmission of plant viruses by psyllids, beetles and mites. Epidemiology and management of insect transmitted diseases through vector management.	3
Practical 1. Identification of common vectors of plant pathogens- aphids, leafhoppers, whiteflies, thrips, beetles, nematodes; 2. Culturing and handling of vectors; demonstration of virus transmission through vectors- aphids, leafhoppers and whiteflies; 3. Vector rearing and maintenance; 4. Estimating vector transmission efficiency, studying vector-virus host interaction.		
Suggested Readings: 1. Basu AN. 1995. Bemisia tabaci (Gennadius) – Crop Pest and Principal Whitefly Vector of Plant Viruses. Oxford and IBH, New Delhi.		

2. Harris KF and Maramarosh K. (Eds.). 1980. Vectors of Plant Pathogens. Academic Press, London.
3. Maramorosch K and Harris KF. (Eds.). 1979. Leafhopper Vectors and Plant Disease Agents. Academic Press, London.
4. Youdeovei A and Service MW. 1983. Pest and Vector Management in the Tropics. English Language Books Series, Longman, London.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
1. Students are expected to be well versed with insect vectors of plant pathogens, acquire knowledge on disease transmission and vector management techniques. 2. Identify key insect vectors responsible for transmitting major plant diseases. 3. Explain transmission mechanisms of plant pathogens by insect vectors. 4. Diagnose vector-borne plant disease symptoms and differentiate them from non-vector-caused disorders. 5. Design and recommend effective vector control strategies, integrating biological, cultural, and chemical methods.	

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D.	Year: II	
Class: M.Sc. (Ag.) Entomology	Semester: III	
Credits: 3	Subject: Entomology	
Theory: 2		
Practical: 1		
Course Code: ENT-514	Title: Vertebrate Pest Management	
Course Objectives: 1. Understand the biology and ecology of major vertebrate pests affecting agriculture, forestry, and urban areas. 2. Study the types and extent of damage caused by vertebrates such as rodents, birds, and wild animals. 3. Learn about traditional and modern methods for managing vertebrate pests. 4. Assess the environmental, legal, and ethical aspects of vertebrate pest control. 5. Explore integrated and sustainable management strategies to minimize vertebrate pest damage.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 1, Practical 1 = 2 Credits		
L: 1 T: 1 P: 01 (In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 2 Hrs.=2 Credit 4Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to vertebrate pests of different crops; biology of vertebrate pests such as rodents, birds and other mammals.	5
II	Bio-ecology of birds of agricultural importance, patterns of pest damage and assessment, roosting and nesting systems in birds; management of pestiferous birds; conservation of predatory birds.	5
III	Bio-ecology of rodents of agricultural importance, patterns of pest damage and assessment, burrowing pattern and habitat of rodents; management of pestiferous rodents.	5
IV	Bio-ecology of higher vertebrates of agricultural importance, patterns of damage and assessment, their habitat; management of pestiferous vertebrates.	5
V	Management strategies- physical (trapping, acoustics and visual), chemical (poisons, repellents, fumigants and anticoagulants), biological (predators, parasites), cropping practices, alteration of habitats, diversion baiting and other eco-friendly methods Operational practices- baiting, equipments and educative programmes.	5

Practical

Identification of important rodents, birds and other vertebrate pests of agriculture, food preference and hoarding; Social behaviour, damage assessment, field survey, population estimation, management strategies: preventive and curative methods.

Suggested Readings:

1. Anderson JM and Ingram JSI. 1993. Tropical Soil Biology and Fertility: A Handbook of Methods. CABI, London.
2. Chhillar BS, Gulati R and Bhatnagar P. 2007. Agricultural Acarology. Daya Publ. House, New Delhi.
3. Dindal DL. 1990. Soil Biology Guide. A Wiley-Inter Science Publ., John Wiley and Sons, New York.
4. Gerson U and Smiley RL. 1990. Acarine Biocontrol Agents – An Illustrated Key and Manual. Chapman and Hall, New York.
5. Gupta SK. 1985. Handbook of Plant Mites of India. Zoological Survey of India, Calcutta.
6. Gwilyn O and Evans GO. 1998. Principles of Acarology. CABI, London.
7. Jeppson LR, Keifer HH and Baker EW. 1975. Mites Injurious to Economic Plants. University of California Press, Berkeley.
8. Krantz GW. 1970. A Manual of Acarology. Oregon State Univ. Book Stores, Corvallis, Oregon.
9. Pankhurst C, Dube B and Gupta, V. 1997. Biological Indicators of Soil Health. CSIRO, Australia.
10. Qiang Zhiang Z. 2003. Mites of Green Houses-Identification, Biology and Control. CABI, London.
11. Sadana GL. 1997. False Spider Mites Infesting Crops in India. Kalyani Publishers House, New Delhi.
12. Walter DE and Proctor HC. 1999. Mites- Ecology, Evolution and Behaviour. CABI, London.
13. Veeresh GK and Rajagopal D. 1988. Applied Soil Biology and Ecology. Oxford and IBH Publ., New Delhi.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

1. Students are expected to identify mites up to family level.
2. Acquire knowledge of mite pests of cultivated crops, their nature of damage, life history traits and effective management.
3. **Evaluate risks and implications** of vertebrate pest management strategies on non-target species and ecosystems.
4. **Develop integrated vertebrate pest management plans** suitable for specific agro-ecological zones.



Evaluation Scheme

M. Sc (Ag.) Genetics & Plant Breeding

Year: I / Semester: I

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	GPB-501	Principles of Genetics	3	2	1	50	20	30	60	100
2	GPB-502	Principles of Plant Breeding	3	2	1	50	20	30	60	100
3	GPB-505	Principles of Cytogenetics	3	2	1	50	20	30	60	100
4	GPB-511	Crop Breeding-I (Kharif crops)	3	2	1	50	20	30	60	100
5	STAT-502	Statistical Methods for Applied Sciences	4	3	1	50	20	30	60	100
6	MCA-511	Introduction to Networking and Internet Applications	2	1	1	50	20	30	60	100
7	PGS-501	Library and Information Services	1	0	1	-	100	0	60	100
8	PGS-503	Intellectual Property and its management in Agriculture	1	1	0	70	0	30	60	100
Total			20	13	7	370	220	210	480	800

Year: I / Semester: II

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	GPB-503	Fundamentals of Quantitative Genetics	3	2	1	50	20	30	60	100
2	GPB-504	Varietal Development and Maintenance Breeding	2	1	1	50	20	30	60	100
3	GPB-506	Molecular Breeding and Bioinformatics	3	2	1	50	20	30	60	100
4	GPB-512	Crop Breeding-II (Rabi crops)	3	2	1	50	20	30	60	100
5	GPB-516	Breeding for Stress Resistance and Climate Change	3	2	1	50	20	30	60	100

6	ENTO-509	Pests of Field Crops	3	2	1	50	20	30	60	100
7	PL.PATH-505	Principales of Plant Pathology	3	2	1	50	20	30	60	100
8	PGS-502	Technical Writing and Communications Skills	1	0	1	0	100	0	60	100
9	GPB-591	Master's Seminar	1	0	1	0	0	100	60	100
10	GPB-599	Master's Research	0	0	0	0	0	0	0	0
Total			22	13	9	350	240	310	540	900

Year: II / Semester: III

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	GPB-510	Seed Production and Certification	2	1	1	50	20	30	60	100
2	PL.PATH-515	Diseases of Field and Medicinal Crops	3	2	1	50	20	30	60	100
3	GPB-507	Breeding for Quality and Special Traits	3	2	1	50	20	30	60	100
4	GPB-508	Mutagenesis and Mutation Breeding	3	2	1	50	20	30	60	100
5	GPB-509	Hybrid Breeding	3	2	1	50	20	30	60	100
6	PGS-504	(e-Course) Basic Concepts in Laboratory Techniques	1	0	1	0	100	0	60	100
7	PGS-505	(e-Course) Agricultural Research, Research Ethics and Rural Development Programmes	1	1	0	70	0	30	60	100
8	GPB-599	Master's Research	10	0	0	0	0	0	0	0
Total			26	10	6	320	200	180	420	700



Year: II / Semester: IV

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	GPB-599	Master's Research	20	-	-	100	-	-	60	100
Total			20							100

Format-3

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D. Class: M.Sc. (Agri.) Genetics and Plant Breeding		Year: I Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Genetics and Plant Breeding
Course Code: GPB-501		Title: Principles of Genetics
Course Objectives: 1. To build knowledge on the fundamentals of genetics, heredity, or inheritance. 2. To build the foundation on the understanding of biological principles. 3. To develop the understanding of life processes - survival and maintenance. 4. To enhance the skill in the applications of the genetic principles in day-to-day life. 5. To propagate the science of genetics.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 2 T:0 P: 1 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Beginning of genetics, early concepts of inheritance, Mendel’s laws; Discussion on Mendel’s paper, Chromosomal theory of inheritance; Multiple alleles, Gene interactions, Sex determination, differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkage-detection, estimation; Recombination and genetic mapping in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance.	6
II	Mendelian population, Random mating population, Frequencies of genes and genotypes, Causes of change: Hardy-Weinberg equilibrium.	6
III	Nature, structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code; Protein biosynthesis, Genetic fine structure analysis, Allelic complementation, Split genes, overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters; Regulation of gene activity in prokaryotes and eukaryotes; Molecular mechanisms of mutation, repair and suppression; Bacterial plasmids, insertion (IS) and transposable (Tn) elements; Molecular chaperones and gene expression, RNA editing.	6
IV	Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning, positional cloning; Nucleic acid hybridization and immunochemical	6

	detection; DNA sequencing; DNA restriction and modification, Anti-sense RNA and ribozymes; Micro-RNAs (miRNAs).	
V	Genomics and proteomics; metagenomics; Transgenic bacteria and bioethics; Gene silencing; genetics of mitochondria and chloroplasts. Concepts of Eugenics, Epigenetics, Genetic disorders.	6

Practical

1. Laboratory exercises in probability and chi-square.
2. Demonstration of genetic principles using laboratory organisms.
3. Chromosome mapping using three-point test cross.
4. Tetrad analysis; Induction and detection of mutations through genetic tests.
5. DNA extraction and PCR amplification.
6. Electrophoresis: basic principles and running of amplified DNA.
7. Extraction of proteins and isozymes.
8. Use of Agrobacterium mediated method and Biolistic gun.
9. Detection of transgenes in the exposed plant material.
10. Visit to transgenic glasshouse and learn the practical considerations

Reference / Textbooks:

- Daniel LH and Maryellen R. 2011. Genetics: "Analysis of Genes and Genomes". Gardner EJ and Snustad DP. 1991. Principles of Genetics. John Wiley and Sons. 8th ed. 2006
- Klug WS and Cummings MR. 2003. Concepts of Genetics. Peterson Edu. Pearson Education India; Tenth edition
- Singh B.D. 2009. Genetics. Kalyani Publishers (2nd Revised Edition)
- Snustad DP and Simmons MJ. 2006. Genetics. 4th Ed. John Wiley and Sons. 6th Edition International Student Version edition
- Stansfield WD.1991. Genetics. Schaum Outline Series Mc Graw Hill
- Strickberger MW. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India; 3rd ed., 2015
- Tamarin RH. 1999. Principles of Genetics. Wm. C. Brown Pubs., McGraw Hill Education; 7th edition
- Uppal S, Yadav R, Singh S and Saharan RP. 2005. Practical Manual on Basic and Applied Genetics. Dept. of Genetics, CCS HAU Hisar.

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	
3) Practical/Research Project Report/Seminar on Research Project Report	20
5) ESE	50
Total:	100
Prerequisites for the course:	

Course Learning Outcomes:

- Learn a historical overview of genetics and understand how a fully formed concept of genetics was put forth.
- Learning the laws of Inheritance in pea plants and other systems
- Understand the applications of Mendel's principles
- Know the various deviation mechanisms in understanding the laws of inheritance.
- Learn the various gene interactions and their outcome.
- Learn linkage and crossing over and their role in breeding experiments.

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: M.Sc. (Agri.) Genetics and Plant Breeding		Year: I
Credits: 3 Theory: 2 Practical:1		Semester: I
Course Code: GPB-502		Subject: Genetics and Plant Breeding
Title: Principles of Plant Breeding		
Course Objectives: 1. The aim of plant breeding is to improve the yield of economic produce. 2. To get acquainted with different techniques ranging from simply selecting plants. 3. Desirable characteristics for propagation, to more complex molecular techniques for breeding new varieties,		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L:2 T: 0 P: 1 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Early Plant Breeding; Accomplishments through plant breeding; Objectives of plant breeding; Patterns of Evolution in Crop Plants: Centre of Origin, Agrobiodiversity and its significance. Pre-breeding and plant introduction and role of plant genetic resources in plant breeding.	6
II	Genetic basis of breeding: self- and cross-pollinated crops including mating systems and response to selection; Nature of variability, components of variation; Heritability and genetic advance, genotype environment interaction; General and specific combining ability; Types of gene actions and implications in plant breeding.	6
III	Pure line theory, pure line and mass selection methods; pedigree, bulk, backcross, single seed descent and multiline breeding; Population breeding in self-pollinated crops with special reference to diallel selective mating; Transgressive breeding.	6
IV	Breeding methods in cross pollinated crops; Population breeding: mass selection and ear-to-row methods; S1 and S2 progeny testing, progeny selection schemes, recurrent selection schemes for intra and inter-population improvement and development of synthetics and composites. Hybrid breeding: genetical and physiological basis of heterosis and inbreeding, production of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance; seed	6

	production of hybrid and their parent varieties/ inbreds. Self-incompatibility, male sterility and apomixes in crop plants and their commercial exploitation.	
V	Breeding methods in asexually/ clonally propagated crops, clonal selection. Special breeding techniques: Mutation breeding, Breeding for abiotic and biotic stresses; Concept of plant ideotype and its role in crop improvement, concept of MAS, concept of polyploidy and wide hybridization, doubled haploidy. Cultivar development: testing, release and notification, maintenance breeding, Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights.	6
Practical 1. Floral biology in self- and cross-pollinated species. 2. Selfing and crossing techniques. 3. Selection methods in segregating populations and evaluation of breeding material. 4. Analysis of variance (ANOVA). 5. Estimation of heritability and genetic advance. 6. Maintenance of experimental records. 7. Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1 8. Learning techniques in hybrid seed production using male-sterility in field crops. 9. Prediction of performance of double cross hybrid.		
Reference / Textbooks: 1. Principles of Plant Breeding (1st & 2nd Edition) by RW Allard. 2. Plant Breeding: Principles & Practices by JR Sharma. 3. Fundamental of Plant Breeding - B. D. Singh and Payal Bansal 4. Fundamental of Plant Breeding – Phundan Singh 5. Principles and Procedures of Plant Breeding - Biotechnical and Conventional Approaches by GS Chahal and SS Gosal. 6. Principles of Plant Genetics and Breeding by George Acquaah. 7. Principles of Plant Breeding ICAR eCourse Link		
If the course is available as Generic Elective, then the students of the following departments may opt for it.		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal		
3) Practical/Research Project Report/Seminar on Research Project Report		20
5) ESE		50
Total:		100
Prerequisites for the course:		
Course Learning Outcomes: 1. Learn breeding procedures in self- and cross-pollinated crops. 2. Understand exploitation of heterosis utilizing male sterility and other methods. 3. Know about the various population improvement programmes. 4. Study about the fundamentals of mutation, polyploidy and wide hybridization and their role in crop improvement.		

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree /UG(R)/PG/Ph.D. Class: M.Sc. (Ag) in Genetics and Plant Breeding		Year: I
Credits: 3 Theory: 2 Practical: 1		Semester: I
Course Code: GPB -511		Subject: Genetics and Plant Breeding
Course Objectives: 1. To understand the principles and methods of crop improvement in kharif season crops. 2. To study the genetic architecture and breeding behavior of major kharif crops. 3. To learn about various breeding techniques including hybridization and selection. 4. To develop skills for identifying desirable traits in kharif crops like rice, maize, sorghum, etc. 5. To evaluate improved varieties for yield, resistance, and adaptability in different agro-climatic zones.		Title: Crop Breeding I (<i>Kharif</i> Crops)
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 P: 01 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)		
Unit	Contents	No. of Lectures Allotted
I	Rice: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1 biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement, Aerobic rice, its implications and drought resistance breeding. Maize: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement- QPM and Bt maize – strategies and implications. Small millets: Evolution and distribution of species and forms - wild relatives and germplasm; Cytogenetics and genome relationship - breeding objectives yield, quality characters, biotic and abiotic stress resistance, etc.	6

II	Pigeon pea: evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement - Hybrid technology; maintenance of male sterile, fertile and restorer lines, progress made at National and International institutes. Groundnut: Origin, evolution mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship, breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement. Other pulses: Urdbean, mungbean, cowpea,: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship, breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), released varieties, examples of MAS used for improvement. Interspecific crosses attempted and its implications, reasons for failure, ways of overcoming them.	6
III	Soybean: Origin, evolution, mode of reproduction, chromosome number; Genetics– cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement. Castor and Sesame: Origin, evolution mode of reproduction, chromosome number; Genetics –cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), released varieties, examples of MAS used for improvement; Hybrid breeding in castor – opportunities, constraints and achievements.	6
IV	Cotton: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, Plant Sciences–Genetics and Plant Breeding biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement, Development and maintenance of male sterile lines – Hybrid development and seed production – Scenario of Bt cottons, evaluation procedures for Bt cotton. Jute: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement.	6
V	Sugarcane: Evolution and distribution of species and forms, wild relatives and germplasm; Cytogenetics and genome relationship – Breeding objectives- yield, quality characters, biotic and abiotic stress resistance, etc. Forage crops: Evolution and distribution of species and forms – Wild relatives	6

	and germplasm; Cytogenetics and genome relationship; Breeding objectives- yield, quality characters and palatability studies; Biotic and abiotic stress resistance, etc. Seed spices: Origin, evolution, mode of reproduction, chromosome number; Genetics- cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc.; Breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement; Achievements of important spice crops.	
Practical 1. Floral biology, emasculation, pollination techniques in rice, maize, pigeon pea, soybean, sesame, cotton; 2. Study of range of variation for yield and yield components; 3. Study of segregating populations in cereal, pulses and oilseed crops; 4. Learning on the crosses between different species; attempting crosses between black gram and green gram; 5. Evaluating the germplasm of cotton for yield, quality and resistance parameters, learning the procedures on development of Bt cotton; 6. Visit to Cotton Technology Laboratory and Spinning Mills; 7. Learning on the Standard Evaluation System (SES) and descriptors; Use of software for database management and retrieval; 8. Practical learning on the cultivation of fodder crop species on sewage water, analysing them for yield components and palatability; 9. Laboratory analysis of forage crops for crude protein, digestibility percent and other quality attributes; 10. Visit to animal feed producing factories; 11. Learning the practice of value addition; Visiting the animal husbandry unit and learning the animal experiments related with palatability and digestibility of fodder.		
Reference / Text Books: 1. Agarwal RL. 1996. <i>Identifying Characteristics of Crop Varieties</i>. Oxford & IBH. 2. Bahl PN and Salimath PM. 1996. <i>Genetics, Cytogenetics and Breeding of Crop Plants</i>. Vol. I. <i>Pulses and Oilseeds</i>. Oxford & IBH. 3. Chandraratna MF. 1964. <i>Genetics and Breeding of Rice</i>. Longmans. 4. Chopra VL and Prakash S. 2002. <i>Evolution and Adaptation of Cereal Crops</i>. Oxford & IBH. 5. Gill KS. 1991. <i>Pearl Millet and its Improvement</i>. ICAR. 6. IRRI. 1964. <i>Rice Genetics and Cytogenetics</i>. Elsevier. 7. IRRI. 1986. <i>Rice Genetics</i>. Proc. International Rice Genetics Symposium. IRRI, Los Banos, Manila, Philippines. 8. IRRI. 1991. <i>Rice Genetics II</i>. Proc. International Rice Genetics Symposium. IRRI, Los Banos, Manila, Philippines. 9. IRRI. 1996. <i>Rice Genetics III</i>. Proc. International Rice Genetics Symposium. IRRI, Los Banos, Manila, Philippines. 10. IRRI. 2000. <i>Rice Genetics IV</i>. Proc. International Rice Genetics Symposium. IRRI, Los Banos, Manila, Philippines. 11. Jennings PR, Coffman WR and Kauffman HE. 1979. <i>Rice Improvement</i>. IRRI, Los Banos, Manila, Philippines.		
If the course is available as Generic Elective, then the students of the following departments may opt		

for it.	
1.	
2.	
3.	
Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	
3) Practical/Research Project Report/Seminar on Research Project Report	20
5) ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: After completing this course, the student will be able to know about important botanical status and reproductive structures of crops and genetics of important kharif field crops.	

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: M.Sc. (Agri.) Genetics and Plant Breeding		Year: I
Credits: 3 Theory: 2 Practical: 1		Semester: I
Course Code: GPB-505		Subject: Genetics and Plant Breeding
Course Objectives: 1. To provide insight into structure and functions of chromosomes. 2. Chromosome mapping, polyploidy and cytogenetic aspects of crop evolution.		Title: Principles of Cytogenetics
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory-02, Practical- 01, Total Credits-03		
L: T: 92 P: 103 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Cell cycle and architecture of chromosome in prokaryotes and eukaryotes; Chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; artificial chromosome construction and its uses; Special types of chromosomes. Variation in chromosome structure: Evolutionary significance; Introduction to techniques for karyotyping; Chromosome banding and painting – <i>Insitu</i> hybridization and various applications.	8
II	Structural and numerical variations of chromosomes and their implications; Symbols and terminologies for chromosome numbers, euploidy, haploids, diploids and polyploids; Utilization of an euploids in gene location; Variation in chromosome behaviour, somatic segregation and chimeras, endomitosis and somatic reduction; Evolutionary significance of chromosomal aberrations, balanced lethal and chromosome complexes; Inter-varietal chromosome substitutions.	8
III	Fertilization barriers in crop plants at pre-and post-fertilization levels; <i>In-vitro</i> techniques to overcome the fertilization barriers in crops; Polyploidy. Genetic consequences of polyploidization and role of polyploids in crop breeding; Evolutionary advantages of autopolyploid vs allopolyploids; Role of aneuploids in basic and applied aspects of crop breeding, their maintenance and utilization in gene mapping and gene blocks transfer; Alien addition and substitution lines, creation and utilization; Apomixis, evolutionary and genetic problems in crops with apomixes.	8
IV	Reversion of autopolyploid to diploids; Genome mapping in polyploids;	8

	Interspecific hybridization and allopolyploids; Synthesis of new crops (wheat, <i>Triticale</i> , <i>Brassica</i> , and cotton); Hybrids between species with same chromosome number, alien translocations; Hybrids between species with different chromosome numbers; Gene transfer using amphidiploids, bridge species.	
V	Chromosome manipulations in wide hybridization; case studies; Production and use of haploids, dihaploids and doubled haploids in genetics and breeding. Plant Sciences–Genetics and Plant Breeding.	8

Practical

1. Learning the cytogenetical laboratory techniques, various chemicals to be used for fixation, dehydration, embedding, staining, cleaning, etc.; Microscopy: various types of microscopes.
2. Preparing specimens for observation.
3. Fixative preparation and fixing specimens for light microscopy studies in cereals.
4. Studies on mitosis and meiosis in crop plants.
5. Using micrometres and studying the pollen grain size in various crops. Pollen germination *in vivo* and *in-vitro*; Demonstration of polyploidy.

Reference / Textbooks:

1. Becker K and Hardin J. 2004. *World of the Cell*. 5th Ed. Pearson Edu. 9th edition.
2. Carroll M. 1989. *Organelles*. The Guilford Press.
3. Charles B. 1993. *Discussions in Cytogenetics*. Prentice Hall Publications.
4. Darlington CD and La Cour LF. 1969. *The Handling of Chromosomes*. George Allen & Unwin Ltd.
5. Elgin SCR. 1995. *Chromatin Structure and Gene Expression*. IRL Press, Oxford.
6. Gupta PK and Tsuchiya T. 1991. *Chromosome Engineering in Plants: Genetics, Breeding and Evolution*. Part A.
7. Gupta PK. 2010. *Cytogenetics*. Rastogi Publishers.
8. Johansson DA. 1975. *Plant Micro technique*. McGraw Hill.
9. Karp G. 1996. *Cell and Molecular Biology: Concepts and Experiments*. John Wiley & Sons.
10. Khush GS. 1973. *Cytogenetics of aneuploids*. Elsevier. 1 edition.
11. Roy D. 2009. *Cytogenetics*. Alpha Science Intl Ltd.
12. Schulz SJ. 1980. *Cytogenetics- Plant, animals and Humans*. Springer.
13. Sharma AK and Sharma A. 1988. *Chromosome Techniques: Theory and Practice*. Butterworth-Heinemann publisher 2014. 3rd edition
14. Singh RJ. 2016. *Plant Cytogenetics* 3rd Edition. CRC Press.
15. Sumner AT. 1982. *Chromosome Banding*. Unwin Hyman Publ. 1 edition, Springer pub.
16. Swanson CP. 1960. *Cytology and Cytogenetics*. Macmillan & Co.

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	5
3) Practical/Research Project Report/Seminar on Research Project Report	15
	50

5) ESE	
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: 1. The course will provide full knowledge to the student on the various procedures linked with cell development and chromosome structure and function. 2. This course will also enable students to tailor and utilize the variation in chromosome numbers and structures in the development and synthesis of new species and varieties.	

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: M.Sc. (Agri.) Genetics and Plant Breeding		Year: I Semester: II
Credits: 3 Theory: 2 Practical:1		Subject: Genetics and Plant Breeding
Course Code: GPB-503		Title: Fundamentals of Quantitative Genetics
Course Objectives: 1. To have a thorough understanding of the general concepts in quantitative genetics. 2. To have the foundation for advanced studies in semester 2 in evolutionary, human and animal breeding genetics. 3. Understand quantitative genetic theory and principles as they apply to plant breeding.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L:2 T: 0 P: 1 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction and historical background of quantitative genetics, Multiple factor hypothesis, Qualitative and quantitative characters, Analysis of continuous variation mean, range, SD, CV; Components of variation- Phenotypic, Genotypic, Nature of gene action- additive, dominance and epistatic, linkage effect. Principles of analysis Plant Sciences–Genetics and Plant Breeding of variance and linear model, Expected variance components, Random and fixed effect model, Comparison of means and variances for significance.	6
II	Designs for plant breeding experiments- principles and applications; Variability parameters, concept of selection, simultaneous selection modes and selection of parents, MANOVA.	6
III	Association analysis- Genotypic and phenotypic correlation, Path analysis discriminates function and principal component analysis, Genetic divergence analysis- Metroglyph and D2, Generation mean analysis, Parent progeny regression analysis	6
IV	Mating designs- classification, Diallel, partial diallel, $L \times T$, NCDs, and TTC; Concept of combining ability and gene action, $G \times E$ Interaction-Adaptability and stability; Methods and models for stability analysis; Basic models- principles and interpretation, Bi-plot analysis.	6

V	QTL mapping, Strategies for QTL mapping- Desired population and statistical methods, QTL mapping in genetic analysis; Markers, Marker assisted selection and factors influencing the MAS, Simultaneous selection based on marker and phenotype.	6
Practical 1. Analysis and interpretation of variability parameters. 2. Analysis and interpretation of Index score and Metroglyph. 3. Clustering and interpretation of D2 analysis. 4. Genotypic and phenotypic correlation analysis and interpretation. 5. Path coefficient analysis and interpretation, 6. Estimation of different types of heterosis, inbreeding depression and interpretation. 7. A, B and C Scaling tests. 8. $L \times T$ analysis and interpretation, QTL analysis. 9. Use of computer packages. 10. Diallel analysis. 11. $G \times E$ interaction and stability analysis.		
Reference / Textbooks: 1. Bos I and Caligari P. 1995. <i>Selection Methods in Plant Breeding</i>. Chapman & Hall. 2. Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1 3. Roy D. 2000. <i>Plant Breeding: Analysis and Exploitation of Variation</i>. Narosa Publishing House, New Delhi. 4. Sharma JR. 2006. <i>Statistical and Biometrical Techniques in Plant Breeding</i>. New Age International Pvt. Ltd. 5. Singh P and Narayanan SS. 1993. <i>Biometrical Techniques in Plant Breeding</i>. Kalyani Publishers, New Delhi. 6. Singh RK and Chaudhary BD. 1987. <i>Biometrical Methods in Quantitative Genetic analysis</i>. Kalyani Publishers, New Delhi.		
If the course is available as Generic Elective, then the students of the following departments may opt for it. 1. 2. 3.		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal		
3) Practical/Research Project Report/Seminar on Research Project Report		20
4) ESE		50
Total:		100
Prerequisites for the course:		
Course Learning Outcomes: 1. Understand quantitative genetic theory and principles as they apply to plant breeding. 2. Read, understand and evaluate literature involving quantitative genetics as it relates to plant breeding. 3. Design, execute, analyse, and interpret results of experiments involving polygenically controlled characters of interest in a plant breeding program.		

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/ UG(R)/PG/Ph.D. Class: M.Sc. (Agri.) Genetics and Plant Breeding		Year: I Semester: II
Credits: 2 Theory: 1 Practical: 1		Subject: Genetics and Plant Breeding
Course Code: GPB -504		Title: Varietal Development and Maintenance Breeding
Course Objectives: 1. To equip students with the knowledge and skills to develop and maintain superior crop varieties. 2. Ensuring high-quality seed production and genetic purity.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 1, Practical- 1, Total Credits- 2		
L:1 T: 0 P: 1 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Variety Development systems and Maintenance; Definition- variety, cultivar, extant variety, essentially derived variety, independently derived variety, reference variety, farmers' variety, landraces, hybrid, and population; Variety testing, release and notification systems and norms in India and abroad.	8
II	DUS testing- DUS Descriptors for major crops; Genetic purity concept and maintenance breeding. Factors responsible for genetic deterioration of varieties - safeguards during seed production. Plant Sciences–Genetics and Plant Breeding	8
III	Maintenance of varieties in self- and cross-pollinated crops, isolation distance; Principles of seed production; Methods of nucleus and breeder seed production; Generation system of seed multiplication -nucleus, breeders, foundation, certified.	8
IV	Quality seed production technology of self and cross-pollinated crop varieties, viz., cereals and millets (wheat, barley, paddy, pearl millet, sorghum, maize and ragi, etc.); Pulses (greengram, blackgram, cowpea, pigeonpea, chickpea, fieldpea, lentil); Oilseeds (groundnut, soybean, sesame, castor, sunflower, safflower, linseed, rapeseed and mustard); fibres (cotton/ jute) and forages (guar, forage sorghum, teosinte, oats, berseem, lucerne).	8
V	Seed certification procedures; Seed laws and acts, plant variety protection regulations in India and international systems.	8
Practical		

1. Identification of suitable areas/ locations for seed production.
2. Ear-to-row method and nucleus seed production.
3. Main characteristics of released and notified varieties, hybrids and parental lines; PGMS and TGMS.
4. Identification of important weeds/ objectionable weeds.
5. Determination of isolation distance and planting ratios in different crops; Seed production techniques of varieties in different crops.
6. Hybrid seed production technology of important crops.
7. DUS testing and descriptors in major crops.
8. Variety release proposal formats in different crops.

Reference / Textbooks:

1. Agarwal RL. 1997. *Seed Technology*. 2nd Ed. Oxford & IBH.
2. Kelly AF. 1988. *Seed Production of Agricultural Crops*. Longman.
3. McDonald MB Jr and Copeland LO. 1997. *Seed Production: Principles and Practices*. Chapman & Hall.
4. Poehlman JM and Borthakur D. 1969. *Breeding Asian Field Crops*. Oxford & IBH.
5. Singh BD. 2005. *Plant Breeding: Principles and Methods*. Kalyani. 2015
6. Thompson JR. 1979. *An Introduction to Seed Technology*. Leonard Hill
7. Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	05
3) Practical/Research Project Report/Seminar on Research Project Report	15
4) ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

1. The purpose of this course is to make students well acquainted with the techniques and procedures of varietal development.
2. He will be associated with development of variety so the course aims is to provide knowledge on DUS testing.
3. Protocols of various breeding techniques, procedures of release of variety.
4. Maintenance of the variety and production of nucleus and breeder seed of variety/ hybrids.

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/ UG(R)/PG/Ph.D. Class: M.Sc. (Agri.) Genetics and Plant Breeding		Year: I Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Genetics and Plant Breeding
Course Code: GPB-506		Title: Molecular Breeding and Bioinformatics
Course Objectives: 1. To impart knowledge and practical skills to use innovative approaches and Bioinformatics in Plant Breeding. 2. The molecular tools and approaches for genotyping and marker assisted breeding, intellectual property rights, bioinformatics tools and their uses in crop improvement.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 2 T: 0 P: 1 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Genotyping; Biochemical and Molecular markers; Morphological, biochemical and DNA-based markers (RFLP, RAPD, AFLP, SSR, SNPs, ESTs, etc.), Functional markers; Mapping populations (F2s, back crosses, RILs, NILs and DH); Molecular mapping and tagging of agronomically important traits; Statistical tools in marker analysis.	8
II	Allele mining; Marker-assisted selection for qualitative and quantitative traits; QTLs analysis in crop plants; Marker-assisted backcross breeding for rapid introgression; Genomics-assisted breeding; Generation of EDVs; Gene pyramiding.	8
III	Introduction to Comparative Genomics; Large scale genome sequencing strategies; Human genome project; Arabidopsis genome project; Rice genome project; Comparative genomics tools; Introduction to proteomics; 2D gel electrophoresis; chromatography and sequencing by Edman degradation and mass spectrometry; Endopeptidases; Nanotechnology and its applications in crop improvement.	8
IV	Recombinant DNA technology, transgenes, method of transformation, selectable markers and clean transformation techniques, vector-mediated gene transfer, physical methods of gene transfer; Production of transgenic plants in various field crops: cotton, wheat, maize, rice, soybean, oilseeds, sugarcane, etc. and commercial releases; Biotechnology applications in male sterility/ hybrid breeding, molecular	8

	farming; Application of Tissue culture in molecular breeding; MOs and related issues (risk and regulations);	
V	GMO; International regulations, biosafety issues of GMOs; Regulatory procedures in major countries including India, ethical, legal and social issues; Intellectual property rights; Introduction to bioinformatics: bioinformatics tools, biological data bases (primary and secondary), implications in crop improvement.	8

Practical

1. Requirements for plant tissue culture laboratory.
2. Techniques in plant tissue culture.
3. Media components and media preparation.
4. Aseptic manipulation of various explants, observations on the contaminants occurring in media, interpretations.
5. Inoculation of explants, callus induction and plant regeneration; Standardizing the protocols for regeneration.
6. Hardening of regenerated plants; Establishing a greenhouse and hardening procedures.

Plant Sciences–Genetics and Plant Breeding

1. Visit to commercial micro propagation unit.
2. Transformation using Agrobacterium strains.
3. GUS assay in transformed cells/ tissues.
4. DNA isolation, DNA purity and quantification tests.
5. Gel electrophoresis of proteins and isozymes, PCR-based DNA markers, gel scoring and data analysis for tagging and phylogenetic relationships.
6. Construction of genetic linkage maps using computer software.
7. NCBI Genomic Resources, GBFF, Swiss Prot, Blast n/ Blast p, Gene Prediction
8. Tool, Expasy Resources, PUBMED and PMC, OMIM and OMIA, ORF finder.
9. Comparative Genomic Resources: - Map Viewer (UCSC Browser and Ensembl).
10. Primer designing- Primer 3/ Primer BLAST.

Reference / Textbooks:

1. Chawala HS. 2000. *Introduction to Plant Biotechnology*. Oxford & IBH Publishing Co. Pvt. Ltd.
2. Chopra VL and Nasim A. 1990. *Genetic Engineering and Biotechnology: Concepts, Methods and Applications*. Oxford & IBH.
3. Gupta PK. 1997. *Elements of Biotechnology*. Rastogi Publ. Hackett PB, Fuchs JA and Messing JW. 1988. *An Introduction to Recombinant DNA Technology- Basic Experiments in Gene Manipulation*. 2nd Ed. Benjamin Publ. Co.
4. Jollès P and Jörnvall H. 2000. *Proteomics in Functional Genomics: Protein Structure Analysis*. Birkhäuser.
5. Singh BD. 2005. *Biotechnology, Expanding Horizons*. Kalyani Publishers, New Delhi.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

1. The knowledge of this course will enable the student to know about various molecular tools and approaches for genotyping.
2. Marker assisted breeding, intellectual property rights, bioinformatics tools and their uses in crop improvement.

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/ UG(R)/PG/Ph.D. Class: M.Sc. (Ag) in Genetics and Plant Breeding		Year: I Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Genetics and Plant Breeding
Course Code: GPB -512		Title: Crop Breeding-II (Rabi Crops)
Course Objectives: 1. To understand the principles and methods of crop breeding with focus on rabi season crops. 2. To study the genetic improvement techniques for wheat, barley, chickpea, lentil, mustard, and other rabi crops. 3. To learn about selection methods, hybridization, and breeding for biotic and abiotic stress resistance. 4. To gain knowledge of recent advances in molecular breeding and varietal development. 5. To develop practical skills through fieldwork and case studies on breeding of rabi crops.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 P: 01 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)		
Unit	Contents	No. of Lectures Allotted
I	Wheat: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement. Oats: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement. Barley: Origin, evolution, center of origin, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement.	6
II	Chickpea: Origin, evolution mode of reproduction, chromosome number;	6

	Genetics – cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement. Other pulses: Lentil, field pea, Rajma, Horse gram: Origin, evolution, mode of reproduction, chromosome number; Genetics. cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement. Interspecific crosses attempted and its implications, reasons for failure, ways of overcoming them.	
III	Rapeseed and Mustard: Origin, evolution, mode of reproduction, chromosome number; Genetics – cytogenetics and genome relationship; Breeding objectives; yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement, Oil quality, Improvement for oil quality. Sunflower, Safflower: Origin, mode of reproduction, chromosome number; Genetics, cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, heterosis breeding, released varieties, examples of MAS used for improvement.	6
IV	Mesta and minor fibre crops: Origin, mode of reproduction, chromosome number; Restructured and Revised Syllabi of Post-graduate Programmes Vol. 1 Genetics–cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, released varieties, examples of MAS used for improvement. Forage crops: Origin, evolution mode of reproduction, chromosome number; Genetics–cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance.	6
V	Seed spices: Origin, evolution, mode of reproduction, chromosome number; Genetics– cytogenetics and genome relationship; Breeding objectives: yield, quality characters, biotic and abiotic stress resistance, etc., breeding approaches, introgression of alien gene(s) (if required), biotic and abiotic stress resistance, scope of heterosis breeding, released varieties, examples of MAS used for crop improvement.	6
Practical 1. Floral biology, emasculation and pollination techniques in wheat, oats, barley, chickpea, rajma, rapeseed mustard, sunflower; 2. Study of range of variation for yield and yield components; 3. Study of segregating populations in cereal, pulses and oilseed crops; 4. Use of descriptors for cataloguing; Learning on the crosses between different species; 5. Trait based screening for stress resistance; 6. Learning on the Standard Evaluation System (SES) and descriptors; 7. Use of software for database management and retrieval.		

Reference / Text Books:

1. Agarwal RL. 1996. *Identifying Characteristics of Crop Varieties*. Oxford & IBH.
2. Bahl PN and Salimath PM. 1996. *Genetics, Cytogenetics and Breeding of Crop Plants*. Vol. I.
3. *Pulses and Oilseeds*. Oxford & IBH.
4. Gupta SK. 2012. *Technological Innovations in Major World Oil crops*. Vol. I. Springer, USA.
5. Gupta SK. 2012. *Technological Innovations in Major World Oil crops*. Vol. II. Springer, USA.
6. Gupta SK. 2016. *Breeding of Oilseed Crops for Sustainable Production*. Academic Press, USA.

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

After completion of this course the student will be able to know about the different breeding methods and genetics of major *Rabi* field crops.

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: M.Sc. (Ag) in Genetics and Plant Breeding		Year: I Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Genetics and Plant Breeding
Course Code: GPB- 516		Title: Breeding for Stress Resistance and Climate Change
Course Objectives: 1. To understand the impact of biotic and abiotic stresses on crop productivity. 2. To study genetic and physiological mechanisms of stress tolerance in plants. 3. To learn breeding strategies for developing stress-resistant crop varieties. 4. To explore modern tools like molecular markers and genomics in stress breeding. 5. To address challenges posed by climate change through resilient crop development.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 P: 01 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)		
Unit	Contents	No. of Lectures Allotted
I	Concept and impact of climatic change; Importance of plant breeding with special reference to biotic and abiotic stress resistance; Classification of biotic stresses – major pests and diseases of economically important crops.	6
II	Concepts of resistance to insect and pathogen resistance; Analysis and inheritance of resistance variation; Host defence responses to pathogen invasions- Biochemical and molecular mechanisms; Acquired and induced immunity and systemic acquired resistance (SAR); Host-pathogen interaction, gene-for-gene hypothesis, molecular evidence for its operation and exceptions; Concept of signal transduction and other host-defence mechanisms against viruses and bacteria.	6
III	Types and genetic mechanisms of resistance to biotic stresses –Horizontal and vertical resistance in crop plants; Quantitative resistance/ adult plant resistance and slow rusting resistance; Classical and molecular breeding methods – Measuring plant resistance using plant fitness; Behavioural, physiological and insect gain studies; Phenotypic screening methods for major pests and diseases; Recording of observations; Correlating the observations using marker data – Gene pyramiding methods and their implications. Classification of abiotic stresses - Stress inducing factors, moisture stress/ drought and water logging and submergence; Acidity,	6

	salinity/ alkalinity/ sodicity; High/ low temperature, wind, etc.; Stress due to soil factors and mineral toxicity; Physiological and Phenological responses; Emphasis of abiotic stresses in developing breeding methodologies.	
IV	Genetics of abiotic stress resistance; Genes and genomics in breeding cultivars suitable to low water regimes and water logging and submergence, high and low/freezing temperatures; Utilizing MAS procedures for identifying resistant types in important crops like rice, sorghum, wheat, cotton, etc.; Breeding for resistance to stresses caused by toxicity, deficiency and pollutants/ contaminants in soil, water and environment.	6
V	Use of crop wild relatives as a source of resistance to biotic and abiotic factors in major field crops; Transgenics in management of biotic and abiotic stresses, use of toxins, protease inhibitors, lectins, chitinases and Bt for diseases and insect pest management.	6

Practical

1. Understanding the climatological parameters and predisposal of biotic and abiotic stress factors- ways of combating them for diseases caused by fungi and bacteria;
2. Symptoms and data recording; use of MAS procedures;
3. Phenotypic screening techniques for sucking pests and chewing pests – Traits to be observed at plant and insect level;
4. Phenotypic screening techniques for nematodes and borers; Ways of combating them;
5. Evaluating the available populations like RIL, NIL, etc. for pest resistance;
6. Use of standard MAS procedures. Breeding strategies - Weeds – ecological, environmental impacts on the crops;
7. Breeding for herbicide resistance;
8. Screening crops for drought and flood resistance; factors to be considered and breeding strategies;
9. Screening varieties of major crops for acidity and alkalinity- their effects and breeding strategies;
10. Screening forage crops for resistance to sewage water and tannery effluents; Quality parameters evaluation.

Reference / Text Books:

1. Blum A. 1988. *Plant Breeding for Stress Environments*. CRC Press.
2. Christiansen MN and Lewis CF. 1982. *Breeding Plants for Less Favourable Environments*. Wiley International.
3. Fritz RS and Simms EL. (Eds.). 1992. *Plant Resistance to Herbivores and Pathogens: Ecology, Evolution and Genetics*. The University of Chicago Press.
4. Li PH and Sakai A. 1987. *Plant Cold Hardiness*. Liss, New York Springer
5. Luginpill P. 1969. *Developing Resistant Plants - The Ideal Method of Controlling Insects*. USDA, ARS, Washington DC.
6. Maxwell FG and Jennings PR. (Eds.). 1980. *Breeding Plants Resistant to Insects*. John Wiley & Sons. Wiley-Blackwell.
7. Roberto F. 2018. *Plant Breeding for Biotic and Abiotic Stress Tolerance*. Springer.
8. Russel GE. 1978. *Plant Breeding for Pest and Disease Resistance*. Butterworths.
9. Sakai A and Larcher W. 1987. *Frost Survival in Plants*. Springer-Verlag.
10. Plant Sciences–Genetics and Plant Breeding Singh BD. 2006. *Plant Breeding*. Kalyani Publishers, New Delhi.
11. Turener NC and Kramer PJ. 1980. *Adaptation of Plants to Water and High Temperature Stress*.
12. John Wiley & Sons. van der Plank JE. 1982. *Host-Pathogen Interactions in Plant Disease*. Academic Press.

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

- 1.
- 2.
- 3.

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	-
3) Practical/Research Project Report/Seminar on Research Project Report	20
4 ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

After completion of this course the student will be able to well verse with the stress and its causes. This will enable the students for the development of RIL, NIL, etc. for pest resistance and Use of standard MAS procedures.

Format-3

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: M.Sc. (Ag) in Genetics and Plant Breeding		Year: II Semester: III
Credits: 2 Theory: 1 Practical: 1		Subject: Genetics and Plant Breeding
Course Code: GPB- 510		Title: Seed Production and Certification
Course Objectives: 1. To understand the importance of seed and seed quality in agriculture. 2. To learn seed multiplication systems and factors affecting seed production and purity. 3. To study principles and techniques of seed production in different crop groups and seed classes. 4. To understand floral biology, pollination, and crop-specific seed production methods. 5. To gain knowledge of seed certification principles, standards, and legal procedures.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 1, Practical- 1, Total Credits- 2		
L: 02 P: 01 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)		
Unit	Contents	No. of Lectures Allotted
I	Importance of seed as basic input in agriculture; Seed quality concept and importance; Generation system of seed multiplication-Varietal replacement rate, Seed multiplication ratios, Seed replacement rate, Seed renewal period and seed demand and supply; Various factors influencing seed production –Physical and Genetic purity in seed production; Factors responsible for varietal and genetic deterioration.	5
II	Nucleus seed production and its maintenance - Maintenance of parental lines of hybrids, Production of breeder, foundation and certified seed and their quality maintenance; Principles of seed production in self- and cross-pollinated crops; Hybrid seed production - system and techniques involved in Seed village concept; Organic seed production and certification.	5
III	Principles of seed production in field crops; Floral structure, pollination mechanism and seed production techniques in self- and cross-pollinated cereals and millets.	5
IV	Floral structure, pollination mechanism and methods and techniques of seed production in major pulses and oilseed crops; Varietal and hybrid seed production techniques in Pigeon pea, Mustard, Castor and Sunflower.	5

V	Floral structure, pollination mechanism and methods and techniques of seed production in major commercial fibres. Hybrid-seed production techniques in major vegetatively propagated crops.	5
VI	Seed certification - history, concept, objectives; Central seed certification board Seed certification agency/ organization and staff requirement; Legal status - Phases of seed certification, formulation, revision and publication of seed certification standards; Minimum Seed Certification Standards (MSCS) for different crops - General and specific crop standards, Field and seed standards; Planning and management of seed certification programs; Eligibility of a variety for certification, area assessment, cropping history of the seed field.	5
Practical 1. Planting design for variety- hybrid seed production techniques, planting ratio of male and female lines, synchronization of parental lines and methods to achieve synchrony; 2. Identification of rogues and pollen shedders, supplementary pollination, detasseling, hand emasculation and pollination; 3. Pollen collection and storage methods, pollen viability and stigma receptivity; 4. Pre-harvest sanitation, maturity symptoms, harvesting techniques; 5. Visits to seed production plots - visit to seed industries; 6. Planning for seed production: cost benefit ratio, seed multiplication ratio and seed replacement rate; 7. General procedure of seed certification, identification of weed and other crop seeds as per specific crops, field inspection at different stages of a crop and observations recorded on contaminants and reporting of results, inspection and sampling, harvesting/ threshing, processing and after processing for seed law enforcement; 9. Specifications for tags and labels to be used for certification purpose.		
Reference / Text Books: 1. Agrawal PK and Dadlani M. 1987. Techniques in Seed Science and Technology, South Asian Publishers, Delhi. 2. Agrawal RL. 1997. Seed Technology, Oxford & IBH Publishing. 3. Anon, 1965. Field Inspection Manual and Minimum Seed Certification Standards, NSC Publication, New Delhi. 4. Anon. 1999. Manual of Seed Certification procedures. Directorate of Seed Certification, Coimbatore, Tamil Nadu. 5. Joshi AK and Singh BD. 2004. Seed Science and Technology, Kalyani Publishers, New Delhi. 6. Kelly AF. 1988. Seed Production of Agricultural Crops. John Wiley, New York. 7. Mc Donald MB and Copeland LO. 1997. Seed Science and Technology, Scientific Publisher, Jodhpur. 8. Ramamoorthy K, Sivasubramaniam K and Kannan M. 2006. Seed Legislation in India. Agrobios (India), Jodhpur, Rajasthan. 9. Singhal NC. 2003. Hybrid Seed Production in Field Crops, Kalyani Publications, New Delhi 10. Tunwar NS and Singh SV. 1988. Indian Minimum Seed Certification Standards. Central Seed Certification Board, Ministry of Agriculture, New Delhi.		
If the course is available as Generic Elective, then the students of the following departments may opt for it. 1. 2.		

3.	
Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	-
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: After completing this course the student will be able to know about seed production of different crop varieties and hybrids, their processing, marketing and seed laws.	

Format-3

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: M.Sc. (Ag) in Genetics and Plant Breeding		Year: II Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Genetics and Plant Breeding
Course Code: GPB-507		Title: Breeding for Quality and Special Traits
Course Objectives: 1. Improve Nutritional Quality: Focus on biofortification, such as increasing protein quality (e.g., amino acid profiles like lysine and tryptophan), oil content, fatty acid composition, vitamins, and essential minerals in cereals, pulses, and oilseeds. 2. Enhance Organoleptic & Market Traits: Breed for improved taste, flavor, aroma, color, and texture in fruits and vegetables, as well as milling and baking qualities in grain crops. 3. Reduce Anti-Nutritional Factors: Develop varieties with reduced levels of toxins, allergens, or anti-nutritional compounds that limit the bioavailability of nutrients. 4. Optimize Industrial & Processing Utility: Modify crops for specific uses like enhanced starch composition, better shelf-life, and processing suitability for food, textile, or pharmaceutical industries. 5. Apply Modern Breeding Techniques: Integrate classical genetics with advanced approaches like Marker-Assisted Selection (MAS) and biotechnology to efficiently select for complex quality traits.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 P: 01 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)		
Unit	Contents	No. of Lectures Allotted
I	Developmental biochemistry and genetics of carbohydrates, proteins, fats, vitamins, amino acids and anti-nutritional factors; Nutritional improvement - A human perspective.	6
II	Breeding for grain quality parameters in rice and its analysis; Golden rice and aromatic rice: Breeding strategies, achievements and application in Indian context; Molecular basis of quality traits and their manipulation in rice; Post harvest manipulation for quality improvement; Breeding for baking qualities in wheat, characters to be considered and breeding strategies, molecular and cytogenetic manipulation for quality improvement in wheat.	6
III	Breeding for quality improvement in Sorghum, pearl millet, barley and oats;	6

	Quality protein maize, specialty corns, concept and breeding strategies; Breeding for quality improvement in important forage crops for stay green traits; Genetic resource management for sustaining nutritive quality in crops.	
IV	Breeding for quality improvement in pulses – Chickpea, pigeonpea, green gram and black gram cooking quality; Breeding for quality in oilseeds -groundnut, mustard, soybean, sesame, sunflower and minor oilseeds; Molecular basis of fat formation and manipulation to achieve more PUFA in oil crops; Genetic manipulation for quality improvement in cotton. Breeding for quality improvement in Sugarcane, potato.	6
V	Genetic engineering protocols for quality improvement: Achievements made; Bio fortification in crops; Classification and importance, Nutritional genomics and Second generation transgenics.	6
Practical 1. Grain quality evaluation in rice; Correlating ageing and quality improvement in rice; 2. Quality analysis in millets; 3. Estimation of anti-nutritional factors like tannins in different varieties/ hybrids: A comparison; 4. Quality parameters evaluation in wheat, pulses and oilseeds; 5. Evaluation of quality parameters in cotton, sugarcane and potato; 6. Value addition in crop plants; 7. Post-harvest processing of major field crops; 8. Quality improvement in crops through tissue culture techniques; 9. Evaluating the available populations like RIL, NIL, etc. for quality improvement using MAS procedures; 10. Successful example of application of MAS for quality trait in rice, mustard, maize, etc.		
Reference / Text Books: 1. Chahal GS and SS Ghosal. 2002. Principles and procedures of plant breeding – Biotechnological and Conventional approaches, Narosa Publications 2. Chopra VL. 1997. Plant Breeding. Oxford & IBH. 2018. 3. FAO 2001. Speciality Rices of the World - Breeding, Production and Marketing. Oxford & IBH, 1 Nov 2001. 4. Ghosh P. 2004. Fibre Science and Technology. Tata McGraw Hill. 5. Gupta SK. 2007. Advances in Botanical Research Vol. 45 Academic Press USA. 6. Hay RK. 2006. Physiology of Crop Yield. 2nd Ed. Blackwell. 7. Nigam J. 1996. Genetic Improvement of Oilseed Crops. Oxford & IBH. 8. Singh BD. 1997. Plant Breeding. Kalyani Publishers, New Delhi. 9. Singh RK, Singh UK and Khush GS. 2000. Aromatic Rices. Oxford & IBH.		
If the course is available as Generic Elective, then the students of the following departments may opt for it. 1. 2. 3.		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal		

3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: The knowledge of this course will expose the student to know about various conventional and genetic engineering techniques for the improvement of quality characters in agricultural and horticultural field crops.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D.		Year: II
Class: M.Sc. (Ag) in Genetics and Plant Breeding		Semester: III
Credits: 3		Subject: Genetics and Plant Breeding
Theory: 2		
Practical: 1		
Course Code: GPB-508		Title: Mutagenesis and Mutation Breeding
Course Objectives: 1. To understand the nature, types, and detection of mutations in crop plants. 2. To study physical and chemical mutagens and their mechanisms of action. 3. To learn methods of mutagen treatment, dosimetry, and factors influencing mutagenesis. 4. To evaluate mutagen effects across generations and assess mutagenic efficiency and effectiveness. 5. To apply mutation breeding techniques for creating useful variability and crop improvement.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 P: 01 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)		
Unit	Contents	No. of Lectures Allotted
I	Mutation and its history, nature and classification of mutations: spontaneous and induced mutations, micro and macro mutations, pre and post adaptive mutations; Detection of mutations. Paramutations in crops plants.	6
II	Mutagenic agents: physical – radiation types and sources: Ionizing and non-ionizing radiations. Radiobiology: mechanism of action of various radiations (photoelectric absorption, Compton scattering and pair production) and their biological effects – RBE and LET relationships; Effect of mutations on DNA – repair mechanisms operating at DNA, chromosome, cell and organism level to counteract the mutation effects; Dosimetry -Objects and methods of treatment; Factors influencing mutation: dose rate, acute vs chronic irradiation, recurrent irradiation, enhancement of thermal neutron effects; Radiation sensitivity and modifying factors: External and internal sources – Oxygen, water content, temperature and nuclear volume.	6
III	Chemical mutagens: Classification – base analogues, antibiotics, alkylating agents, acridine dyes and other mutagens: their properties and mode of action; Dose determination and factors influencing chemical mutagenesis; Treatment methods using physical and chemical mutagens, Combination treatments; other causes of mutation – direct and indirect action, comparative evaluation of physical and	6

	chemical mutagens.	
IV	Observing mutagen effects in M1 generation: plant injury, lethality, sterility, chimeras, etc.; Observing mutagen effects in M2 generation; Estimation of mutagenic efficiency and effectiveness – spectrum of chlorophyll and viable mutations; Mutations in traits with continuous variation; Factors influencing the mutant spectrum: genotype, type of mutagen and dose, pleiotropy and linkage, etc.; Individual plant based mutation analysis and working out effectiveness and efficiency in M3 generation; Comparative evaluation of physical and chemical mutagens for creation of variability in the some species- Case studies.	6
V	Use of mutagens in creating oligogenic and polygenic variations – Case studies; In-vitro mutagenesis – Callus and pollen irradiation; Handling of segregating M2 generations and selection procedures; Validation of mutants; Mutation breeding for various traits (disease resistance, insect resistance, quality improvement, etc.) in different crops; Procedures for micromutations breeding/ polygenic mutations; Achievements of mutation breeding- varieties released across the world, problems associated with mutation breeding. Use of mutagens in genomics, allele mining, TILLING.	6

Practical

1. Precautions on handling of mutagens; Dosimetry-Studies of different mutagenic agents: Physical mutagens and Chemical mutagens;
2. Learning on Radioactivity- Production source and isotopes at BRIT, Trombay, Learning about gamma chamber;
3. Radiation hazards: Monitoring – safety regulations and safe transportation of radioisotopes, visit to radio isotope laboratory; learning on safe disposal of radioisotopes;
4. Hazards due to chemical mutagens – Treating the plant propagules at different doses of physical and chemical mutagens;
5. Procedures in combined mutagenic treatments;
6. Raising the crop for observation; Mutagenic effectiveness and efficiency, calculating the same from earlier literature;
7. Study of M1 generation – Parameters;
8. Study of M2 generation – Parameters;
9. Mutation breeding in cereals and pulses-achievements made and an analysis;
10. Mutation breeding in oilseeds and cotton- achievements and opportunities;
11. Mutation breeding in forage crops and vegetatively propagated crops;
12. Procedure for detection of mutations for polygenic traits in M2 and M3 generations.

Reference / Text Books:

1. Alper T. 1979. Cellular Radiobiology. Cambridge Univ. Press, London.
2. Chadwick KH and Leenhouts HP. 1981. The Molecular Theory of Radiation Biology. Springer-Verlag.
3. Cotton R, Edkin E and Forrest S. 2000. Mutation Detection: A Practical Approach. Oxford Univ. Press.
4. International Atomic Energy Agency. 1970. Manual on Mutation Breeding. International Atomic Energy Agency, Vienna, Italy.
5. Shu QY, Forster BP and Nakagawa N. 2012. Plant Mutation Breeding and Biotechnology. Gutesnberg Press Ltd. Rome Italy ISBN: 978-925107-022-2 (FAO).
6. Singh BD. 2003. Genetics. Kalyani Publishers, New Delhi.

7. Strickberger MW. 2005. Genetics. 3rd Ed. Prentice Hall. www.barc.gov.in	
If the course is available as Generic Elective, then the students of the following departments may opt for it.	
1.	
2.	
3.	
Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes:	
This course will make the student well versed with the process of mutation and its use in crop improvement. This course will also give in depth knowledge of mutations in genomics, allele mining and TILLING.	

Format-3

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/Degree/UG(R)/PG/Ph.D. Class: M.Sc. (Ag) in Genetics and Plant Breeding		Year: II Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Genetics and Plant Breeding
Course Code: GPB-509		Title: Hybrid Breeding
Course Objectives: 1. To understand the concepts, theories, and genetic basis of heterosis. 2. To study prediction of heterosis, inbreeding effects, and genetic distance relationships. 3. To learn the role of male sterility and self-incompatibility in heterosis breeding. 4. To understand hybrid seed production systems and maintenance of parental lines. 5. To study hybrid breeding approaches in major field and oilseed crops.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 P: 01 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)		
Unit	Contents	No. of Lectures Allotted
I	Historical aspect of heterosis, nomenclature and definitions of heterosis; Heterosis in natural population and inbred population; Evolutionary aspects – Genetic consequences of selfing, sibbing and crossing in self-and cross-pollinated and asexually propagated crops; Pre-Mendelian and Post-Mendelian ideas – Evolutionary concepts of heterosis; Genetic theories of heterosis – Physiological, Biochemical and molecular factors underlining heterosis; theories and their estimation; Biometrical basis of heterosis.	6
II	Prediction of heterosis from various crosses, inbreeding depression, coefficient of inbreeding and its estimation, residual heterosis in F ₂ and segregating populations, importance of inbreeding in exploitation of heterosis – case studies.; Relationship between genetic distance and expression of heterosis, case studies; Divergence and genetic distance analyses, morphological and molecular genetic distance in predicting heterosis; Development of heterotic pools in germplasm/genetic stocks and inbreds, their improvement for increasing heterosis.	6
III	Male sterility and use in heterosis breeding; Male sterile line creation and diversification in self-pollinated, cross pollinated and asexually propagated crops; Creation of male sterility through genetic engineering and its exploitation in heterosis; Maintenance, transfer and restoration of different types of male	6

	sterility; Use of self-incompatibility in development of hybrids.	
IV	Hybrid seed production system: 3-line, 2-line and 1-line system; Development of inbreds and parental lines- A, B and R lines – functional male sterility; Commercial exploitation of heterosis, maintenance breeding of parental lines in hybrids; Fixation of heterosis in self, cross and often cross pollinated crops, asexually/ clonally propagated crops, problems and prospects; Apomixis in fixing heterosis-concept of single line hybrid; Organellar heterosis and complementation.	6
V	Hybrid breeding in wheat, rice, cotton, maize, pearl millet, sorghum and rapeseed mustard, sunflower, safflower and castor oilseed crops and pigeonpea.	6

Practical

1. Characterization of male sterile lines using morphological descriptors;
2. Restorer line identification and diversification of male sterile sources;
3. Male sterile line creation in crop plants, problems in creation of CGMS system, ways of overcoming them;
4. Diversification and restoration;
5. Success stories of hybrid breeding in Maize, Rice, Pearl millet, Sorghum and Pigeon pea;
6. Understanding the difficulties in breeding apomicts;
7. Estimation of heterotic parameters in self, cross and asexually propagated crops;
8. Estimation from the various models for heterosis parameters;
9. Hybrid seed production in field crops—an account on the released hybrids, their potential, problems and ways of overcoming it;
10. Hybrid breeding at National and International level, opportunities ahead.

Reference / Text Books:

1. Agarwal RL. 1998. Fundamental of Plant Breeding and hybrid Seed Production. Science Publisher London.
2. Akin E. 1979. The Geometry of Population Genetics. Springer-Verlag.
3. Ben HL. 1998. Statistical Genomics – Linkage, Mapping and QTL Analysis. CRC Press.
4. Chal GS and Gossal SS. 2002. Principles and procedures of Plant Breeding, Biotechnology and Conventional Approaches. Narosa Publishing House. New Delhi
5. De JG. 1988. Population Genetics and Evolution. Springer-Verlag. 30 January 2012
6. Hartl DL. 2000. A Primer of Population Genetics. 3rd Ed. Sinauer Assoc.
7. Mettler LE and Gregg TG. 1969. Population Genetics and Evolution. Prentice-Hall. 25 April 1988
8. Montgomery DC. 2001. Design and Analysis of Experiments. 5th Ed., Wiley & Sons. 2013
9. Mukherjee BK. 1995. The Heterosis Phenomenon. Kalyani Publishers, New Delhi.
10. Proceedings of Genetics and Exploitation of Heterosis in Crops – An International Symposium CIMMYT, 1998.
11. Richards AJ. 1986. Plant Breeding Systems. George Allen & Unwin. 30 May 1997
12. Singh BD. 2006. Plant Breeding. Kalyani Publishers, New Delhi.
13. Srivastava S and Tyagi R. 1997. Selected Problems in Genetics. Vols. I, II. Anmol Publ.
14. Virmani SS. 1994. Heterosis and Hybrid Rice Breeding. Monographs of "Theoretical and Applied Genetics", Springer-Verlag.

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

- 1.
- 2.

3.	
Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	
3) Practical/Research Project Report/Seminar on Research Project Report	20
4) ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: After completing this course, the student will be able to know about importance of heterosis, the various conventional and biotechnological approaches for the development of hybrids. This will also enable student to know about the use of male sterility in hybrid seed production of important field crops.	

Evaluation Scheme

M. Sc (Ag.) Plant Pathology

Year: I / Semester: I

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	PL.PATH-501	Mycology	3	2	1	50	20	30	60	100
2	PL.PATH-502	Plant Virology	3	2	1	50	20	30	60	100
3	PL.PATH-503	Plant Pathogenic Prokaryotes	3	2	1	50	20	30	60	100
4	GPB-501	Principles of Genetics	3	2	1	50	20	30	60	100
5	STAT-502	Statistical Methods for Applied Sciences	4	3	1	50	20	30	60	100
6	MCA-511	Introduction to Networking and Internet Applications	2	1	1	50	20	30	60	100
7	PGS-501	Library and Information Services	1	0	1	0	100	0	60	100
8	PGS-503	Intellectual Property and its management in Agriculture	1	1	0	70	0	30	60	100
Total			20	13	7	370	220	210	480	800

Year: I / Semester: II

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	PL.PATH-505	Principles of Plant Pathology	3	2	1	50	20	30	60	100
2	PL.PATH-506	Techniques in Detection and Diagnosis of Plant Diseases	2	0	2	0	100	0	60	100
3	PL.PATH-511	Chemicals and Botanicals in Plant Disease Management	3	2	1	50	20	30	60	100

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4	PL.PATH-517	Diseases of Vegetable and Spices Crops	3	2	1	50	20	30	60	100
5	ENT-509	Pests of Field Crops	3	2	1	50	20	30	60	100
6	SST-714	Seed Pathology	3	2	1	50	20	30	60	100
7	PGS-502	Technical Writing and Communications Skills	1	0	1	0	100	0	60	100
8	PL.PATH-591	Master's Seminar	1	0	1	0	100	0	60	100
9	PL.PATH-521	Master's research	10	0	0	0	0	0	0	0
Total			29	10	9	250	400	150	480	800

Year: II / Semester: III

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	PL.PATH-515	Diseases of Field and Medicinal Crops	3	2	1	50	20	30	60	100
2	PL.PATH-507	Principles of Plant Disease Management	3	2	1	50	20	30	60	100
	PL.PATH-518	Post-Harvest Diseases	3	2	1	50	20	30	60	100
3	PGS-504	(e-Course) Basic Concepts in Laboratory Techniques	1	0	1	0	100	0	60	100
4	PGS-505	(e-Course) Agricultural Research, Research Ethics and Rural Development Programmes	1	1	0	70	0	30	60	100
5	PL.PATH-521	Master's research	10	0	0	0	0	0	0	0
Total			21	7	4	220	160	120	300	500

Year: II / Semester: IV

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	PL.PATH-521	Master's research	20	-	-	100	-	-	60	100
Total			20							100

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: I
Credits: 3 Theory: 2 Practical: 1		SUBJECT: PLANT PATHOLOGY
Course Code: PL PATH- 501*		TITLE: MYCOLOGY
Course Objectives: • Understanding Mycology and Its Relevance • Exploring Fungal Classification and Nomenclature • Studying Protists and Their Life Cycles • Examining Fungal Structures and Life Cycles • Exploring Economic Importance and Molecular Studies		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 00 P: 02 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction, definition of different terms, basic concepts. Importance of mycology in agriculture, relation of fungi to human affairs. History of mycology.	6
II	Importance of culture collection and herbarium of fungi. Somatic characters and reproduction in fungi. Modern concept of nomenclature and classification, Classification of kingdom fungi: Stramenopila and Protists.	6
III	The general characteristics of protists and life cycle in the Phyla Plasmodiophoromycota, Dictyosteliomycota, Acrasiomycota and Myxomycota. Kingdom Stramenopila: characters and life cycles of respective genera under Hypochytriomycota, Oomycota and Labyrinthulomycota.	6
IV	Kingdom fungi: General characters, ultrastructure and life cycle patterns in representative genera under Chytridiomycota, Zygomycota, Ascomycota; Archiascomycetes, Ascomycetous yeasts, Pyrenomycetes, Plectomycetes, Discomycetes, Loculoascomycetes, Erysiphales and anamorphs of ascomycetous fungi.	6
V	Basidiomycota; general characters, mode of reproduction, types of basidiocarps and economic importance of Hymenomycetes. Uridinales and Ustilaginales; variability, host specificity and life cycle pattern in rusts and smuts. Mitosporic fungi; status of asexual fungi, their teliomorphic relationships, Molecular characterization of plant pathogenic fungi	6

Practical

1. Detailed comparative study of different groups of fungi;
2. Collection of cultures and live specimens;
3. Saccardoan classification and classification based on conidiogenesis;
4. Vegetative structures and different types of fruiting bodies produced by slime molds, stramenopiles and true fungi;
5. Myxomycotina: Fructification, plasmodiocarp, sporangia, plasmodium and aethalia. Oomycota;
6. Somatic and reproductory structures of Pythium, Phytophthora, downy mildews and Albugo, Zygomycetes: Sexual and asexual structures of Mucor, Rhizopus, General characters of VAM fungi. Ascomycetes; fruiting structures, Erysiphales, and Eurotiales;
7. General identification characters of Pyrenomycetes, Discomycetes, Loculoascomycetes and Laboulbenio-mycetes, Basidiomycetes; characters, ultrastructures and life cycle patterns in Ustilaginomycetes and Teliomycetes, Deuteromycetes; Characters of Hyphomycetes and Coelomycetes and their teliomorphic and anamorphic states, Collection, preservation, culturing and identification of plant parasitic fungi;
8. Application of molecular approaches and techniques for identification of fungal pathogens.

Suggested Readings:

1. Ainsworth GC, Sparrow FK and Susman HS. 1973. The Fungi —An Advanced Treatise. Vol. IV (A & B). Academic Press, New York.
2. Alexopoulos CJ, Mims CW and Blackwell M. 2000. Introductory Mycology. 5th Ed. John Wiley & Sons, New York.
3. Maheshwari R. 2016. Fungi: Experimental Methods in Biology 2nd edn. CRC Press, US. Mehrotra RS and Arneja KR. 1990. An Introductory Mycology. Wiley Eastern, New Delhi.
4. Sarbhoy AK. 2000. Text book of Mycology. ICAR, New Delhi.
5. Singh RS. 1982. Plant Pathogens - The Fungi. Oxford & IBH, New Delhi.
6. Webster J. 1980. Introduction to Fungi. 2nd Ed. Cambridge Univ. Press, Cambridge, New York.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

- Demonstrate an understanding of basic mycological terminology, the significance of mycology in agriculture, its historical development, and its relation to human affairs.
- Analyze the modern concepts of fungal nomenclature and classification, distinguishing between the Kingdoms
- Explain the life cycles and general characteristics
- Understand Basidiomycota and Economic Impacts
- Use practical skills and molecular tools for the characterization of plant-pathogenic fungi, including understanding the status and relationships of Mitosporic fungi and their economic implications.

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: I
Credits: 3 Theory: 2 Practical: 1		SUBJECT: PLANT PATHOLOGY
Course Code: PL PATH- 502*		TITLE: PLANT VIROLOGY
Course Objectives: ➤ Understand the history, economic significance, and classification of plant viruses. ➤ Explore the structure, genome organization, replication, and movement of plant viruses. ➤ Examine host-virus interactions and the biochemical, physiological, and symptomatic responses. ➤ Learn techniques for virus detection, isolation, and identification. ➤ Develop strategies for the management of plant diseases caused by viruses, including resistance breeding and integrated approaches.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	History and economic significances of plant viruses. General and morphological characters, composition and structure of viruses. Myco-viruses, arbo and baculo viruses, satellite viruses, satellite RNAs, phages, viroids and prions. Origin and evolution of viruses and their nomenclature and classification.	6
II	Genome organization, replication in selected groups of plant viruses and their movement in host. Response of the host to virus infection: biochemical, physiological, and symptomatically changes.	6
III	Transmission of viruses and virus-vector relationship. Isolation and purification of viruses. Detection and identification of plant viruses by using protein and nucleic acid based diagnostic techniques.	6
IV	Natural (R-genes) and engineering resistance to plant viruses. Virus epidemiology and ecology (spread of plant viruses in fields, host range and survival).	6
V	Management of plant diseases caused by plant viruses such as cultural, Mechanical, chemical and biological management	6

Practical

- Study of symptoms caused by plant viruses (followed by field visit);
- Isolation and biological purification of plant virus cultures;
- Bioassay of virus cultures on indicator plants and host differentials;
- Transmission of plant viruses (Mechanical, graft and vector and study of disease development);
- Plant virus purification (clarification, concentration, centrifugation, high resolution separation and analysis of virions), Electron microscopy for studying viral particle morphology;
- Antisera production, Detection and diagnosis of plant viruses with serological (ELISA), nucleic acid (Non-PCR—LAMP, Later flow micro array and P CR based techniques);
- Exposure to basic bio-informatic tools for viral genome analysis and their utilization in developing detection protocols and population studies (BLASTn tool, Primer designing software, Bioedit tool, Clustal X/W, MEGA Software).

Suggested Readings:

- Bos L. 1964. Symptoms of Virus Diseases in Plants. Oxford & IBH., New Delhi.
- Brunt AA, Krabtree K, Dallwitz MJ, Gibbs AJ and Watson L. 1995. Virus of Plants: Descriptions and Lists from VIDE Database. CABI, Wallington.
- Gibbs A and Harrison B. 1976. Plant Virology — The Principles. Edward Arnold, London. Hull R. 2002. Mathew's Plant Virology. 4th Ed. Academic Press, New York.
- Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments. Oxford & IBH, New Delhi.
- Wilson C. 2014. Applied Plant Virology. CABI Publishing England.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

- Analyze the history, classification, and economic impact of plant viruses.
- Describe the structural, genetic, and functional aspects of plant viruses and related entities.
- Interpret host-virus interactions, including physiological and symptomatic changes in plants.
- Apply diagnostic techniques for detecting, isolating, and identifying plant viruses.
- Devise integrated management strategies for plant diseases caused by viruses.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Plant Pathology
Course Code: PL PATH 503*		Title: Plant Pathogenic Prokaryotes
Course Objectives: - Understand the history, development, and evolution of plant bacteriology and prokaryotic life. - Explore the structural and functional aspects of bacterial cells and their components. - Examine the taxonomy, variability, and mechanisms of infection of phytopathogenic prokaryotes. - Analyze the biochemical and molecular characteristics of phytopathogenic prokaryotes. - Develop strategies for managing diseases caused by phytopathogenic bacteria.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Prokaryotic cell: History and development of Plant bacteriology, history of plant bacteriology in India. Evolution of prokaryotic life, Prokaryotic cytoskeletal proteins. Structure of bacterial cell. Structure and composition of gram negative and gram-positive cell wall; synthesis of peptidoglycan; Surface proteins; Lipopolysaccharide structure; Membrane transport; fimbriae and pili (Type IV pili); Mechanism of flagellar rotatory motor and locomotion, and bacterial movement; Glycocalyx (Slayer; capsule); the bacterial chromosomes and plasmids; Operon and other structures in cytoplasm; Morphological feature of fastidious bacteria, spiroplasmas and Phytoplasmas.	6
II	Growth and nutritional requirements. Infection mechanism, role of virulence factors in expression of symptoms. Survival and dispersal of phytopathogenic prokaryotes.	6
III	Taxonomy of phytopathogenic prokaryotes: Taxonomic ranks hierarchy; Identification, Classification and nomenclature of bacteria, phytoplasma and spiroplasma. The codes of Nomenclature and characteristics. Biochemical and molecular characterization of phytopathogenic prokaryotes.	6
IV	Variability among phytopathogenic prokaryotes: general mechanism of variability (mutation); specialized mechanisms of variability (sexual like process in bacteria conjugation; transformation; transduction); and horizontal gene transfer.	6

V	Bacteriophages, L form of bacteria, plasmids and bdellovibrios: Structure; Infection of host cells; phage multiplication cycle; Classification of phages, Use of phages in plant pathology/ bacteriology, Lysogenic conversion; H Plasmids and their types, plasmid borne phenotypes. Introduction to bacteriocins. Strategies for management of diseases caused by phytopathogenic prokaryotes.	6
Practical ➤ Study of symptoms produced by phytopathogenic prokaryotes; ➤ Isolation, enumeration, purification, identification and host inoculation of phytopathogenic bacteria; ➤ Stains and staining methods; ➤ Biochemical and serological characterization; ➤ Isolation of genomic DNA plasmid; ➤ Use of antibacterial chemicals/ antibiotics; ➤ Isolation of fluorescent Pseudomonas; ➤ Preservation of bacterial cultures; ➤ Identification of prokaryotic organisms by using 16S rDNA, and other gene sequences; ➤ Diagnosis and management of important diseases caused by bacteria and mollicutes.		
Suggested Readings: ➤ Goto M. 1990. Fundamentals of Plant Bacteriology. Academic Press, New York. ➤ Jayaraman J and Verma JP. 2002. Fundamentals of Plant Bacteriology. Kalyani Publishers, Ludhiana. ➤ Mount MS and Lacy GH. 1982. Phytopathogenic Prokaryotes. Vols. I, II Academic Press, New York. ➤ Salle AJ. 1979. Fundamental Principles of Bacteriology 7th edn. ➤ Verma J P, Varma A and Kumar D. (Eds). 1995. Detection of Plant Pathogens and their Management. Angkor Publ., New Delhi		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3. ESE		50
Total:		100
Course Learning Outcomes: • Demonstrate knowledge of the evolution and history of plant bacteriology, including India's contributions. • Identify and explain the structural and functional features of prokaryotic cells. • Classify and describe the taxonomy and variability of phytopathogenic prokaryotes. • Evaluate infection mechanisms, virulence factors, and gene transfer processes. • Formulate effective management strategies for bacterial diseases in plants.		

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.	Year: I	
Class: M. Sc. (Ag) Plant Pathology	Semester: II	
Credits: 3 Theory: 2 Practical: 1	Subject: Plant Pathology	
Course Code: PL PATH 505	Title: Principles of Plant Pathology	
Course Objectives: • To understand the fundamental concepts and importance of plant diseases in agriculture. • To explore the historical development and advancements in plant pathology. • To analyze the impact of biotic and abiotic factors on plant health and disease development. • To investigate host-pathogen interactions, including infection mechanisms and defence strategies. • To study genetic and molecular approaches for developing disease-resistant plants.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Importance, definitions and concepts of plant diseases, history and growth of plant pathology, biotic and abiotic causes of plant diseases.	3
II	Growth, reproduction, survival and dispersal of important plant pathogens, role of environment and host nutrition on disease development.	3
III	Host parasite interaction, recognition concept and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defense strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors. Altered plant metabolism as affected by plant pathogens.	3
IV	Genetics of resistance; 'R' genes; mechanism of genetic variation in pathogens; molecular basis for resistance; marker-assisted selection; genetic engineering for disease resistance.	3
Practical ➤ Basic plant pathological techniques; ➤ Isolation, inoculation and purification of plant pathogens and proving Koch's postulates; ➤ Techniques to study variability in different plant pathogens;		

- Purification of enzymes, toxins and their bioassay;
- Estimation of growth regulators, phenols, phytoalexins in resistant and susceptible plants.

Suggested Readings:

- Agrios GN. 2005. Plant Pathology. 5th Ed. Academic Press, New York.
- Heitefuss R and Williams PH. 1976. Physiological Plant Pathology. Springer Verlag, Berlin, New York.
- Mehrotra RS and Aggarwal A. 2003. Plant Pathology. 2nd Ed. Oxford & IBH, New Delhi.
- Singh RP. 2012. Plant Pathology 2nd edn. Kalyani Publishers, New Delhi.
- Singh RS. 2017. Introduction to Principles of Plant Pathology. 5th edn. Med Tech, New Delhi.
- Singh DP and Singh A. 2007. Disease and Insect Resistance in Plants. Oxford & IBH, New Delhi.
- Upadhyay RK. and Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving Biotechnology. Oxford & IBH, New Delhi.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
• Comprehend the definitions, concepts, and significance of plant diseases in crop management. • Explain the roles of growth, reproduction, and dispersal of pathogens in disease cycles. • Interpret host-pathogen interactions, including symptom development and defense responses. • Evaluate genetic and molecular mechanisms of disease resistance in plants. • Apply knowledge of plant pathology in breeding disease-resistant crops.	

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: II
Credits: 2 Theory: 0 Practical: 2		Subject: Plant Pathology
Course Code: PL PATH 506		Title: Techniques for Detection and Diagnosis of Plant Diseases
Course Objectives: ➤ To impart training on various methods/ techniques/ instruments used in the study of plant diseases/ pathogens. ➤ To develop skills in identifying plant pathogens based on visual symptoms and biochemical tests. ➤ To familiarize students with advanced microscopic and molecular techniques for pathogen detection. ➤ To provide knowledge of selective media and biological assays for isolating and identifying pathogens.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 0, Practical- 2, Total Credits- 2		
L: 00 T: 00 P: 02(In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 4 Hrs.=2 Credit (4Hrs./Week=2Credits)		
Practical	Contents	No. of Lectures Allotted
I	Detection of plant pathogens 1. Based on visual symptoms, 2. Biochemical test.	
II	1. Using microscopic techniques, 2. Cultural studies; (use of selective media to isolate pathogens). 3. Biological assays (indicator hosts, differential hosts) 4. Serological assays 5. Nucleic acid-based techniques (Non-PCR—LAMP, Later flow microarray and PCR based-multiplex, nested, qPCR, immune capture PCR, etc.); Phenotypic and genotypic tests for identification of plant pathogens;	
III	Molecular identification (16S rDNA and 16s-23S rDNA intergenic spacer region sequences-prokaryotic organisms; and eukaryotic organism by ITS region) and whole genome sequencing;	
IV	Volatile compounds profiling by using GC-MS and LC-MS;	
V	FAME analysis, Fluorescence in-situ Hybridization (FISH), Flow Cytometry, Phage display technique, biosensors for detection of plant pathogens;	

VI	Genotypic tools such as genome/ specific gene sequence homology comparison by BLAST (NCBI and EMBL) and electron microscopy techniques of plant virus detection and diagnosis.	
Suggested Readings: ➤ Baudoin ABAM, Hooper GR, Mathre DE and Carroll RB. 1990. Laboratory Exercises in Plant Pathology: An Instructional Kit. Scientific Publ., Jodhpur. ➤ Dhingra OD and Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press, London, Tokyo. ➤ Fox RTV. 1993. Principles of Diagnostic Techniques in Plant Pathology, CABI Wallington. ➤ Forster D and Taylor SC. 1998. Plant Virology Protocols: From Virus Isolation to Transgenic Resistance. Methods in Molecular Biology. Humana Press, Totowa, New Jersey. Mathews REF. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Boca Raton, Tokyo. ➤ Matthews REF. 1993. Diagnosis of Plant Virus Diseases. CRC Press, Florida. ➤ Noordam D. 1973. Identification of Plant Viruses, Methods and Experiments. Cent. Agric. Pub. Doc. Wageningen. ➤ Pathak VN. 1984. Laboratory Manual of Plant Pathology. Oxford & IBH, New Delhi. ➤ Trigiano RN, Windham MT and Windham AS. 2004. Plant Pathology-concepts and Laboratory Exercises. CRC Press, Florida. Chakravarti BP. 2005. Methods of Bacterial Plant Pathology. Agrotech, Udaipur.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks/ Sessional Examination		30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3. ESE		50
Total:		100
Course Learning Outcomes: • Students will be able to diagnose plant diseases using visual, biochemical, and cultural techniques. • They will demonstrate proficiency in molecular and serological assays for pathogen detection. • They will apply genome-based and phenotypic methods for accurate pathogen identification. • Students will gain hands-on experience in using GC-MS, LC-MS, and FAME analysis for volatile compound profiling. • They will evaluate plant pathogens using bioinformatics tools like BLAST and advanced electron microscopy techniques.		

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Plant Pathology
Course Code: PL PATH 507		Title: Principles of Plant Disease Management
Course Objectives: ➤ To understand the principles and methods of plant disease management. ➤ To explore integrated control measures and molecular approaches for disease resistance. ➤ To study the history, properties, and modes of action of fungicides, bactericides, and antibiotics. ➤ To learn the techniques of chemical application and the role of adjuvants in disease control. ➤ To evaluate health, environmental hazards, and safety measures associated with chemical use.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Practical	Contents	No. of Lectures Allotted
I	Principles of plant disease management by cultural, physical, biological, chemical, organic amendments and botanicals methods of plant disease control. Disease resistance and molecular approach for disease management	6
II	Integrated control measures of plant diseases. History of IDM and objective.	6
III	History of fungicides, bactericides, antibiotics, concepts of pathogen, immobilization, chemical protection and chemotherapy, nature, properties and mode of action of antifungal, antibacterial and antiviral chemicals. Label claim of fungicides.	6
IV	Application of chemicals on foliage, seed and soil, role of stickers, spreaders and other adjuvants, health vis-a-vis environmental hazards, residual effects.	6
V	Safety, safety measures of Chemicals in Plant Disease Management	6
Practical ➤ Methods of in-vitro evaluation of chemicals, antibiotics, bio agents against plant pathogens; ➤ Field evaluation of chemicals, antibiotics, bio agents against plant pathogens; ➤ Soil solarisation, methods of soil fumigation under protected cultivation; ➤ Methods of application of chemicals and bio control agents; ➤ ED and MIC values, study of structural details of sprayers and dusters;. Artificial epiphytotic and screening of resistance.		

Suggested Readings:

- Fry WE. 1982. Principles of Plant Disease Management. Academic Press, New York.
- Hewitt HG. 1998. Fungicides in Crop Protection. CABI, Wallington. Marsh RW. 1972. Systemic Fungicides. Longman, New York.
- Nene YL and Thapliyal PN. 1993. Fungicides in Plant Disease Control. Oxford & IBH, New Delhi.
- Palti J. 1981. Cultural Practices and Infectious Crop Diseases. Springer Verlag, New York.
- Vyas SC. 1993 Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw Hill, New Delhi.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

- Demonstrate knowledge of cultural, biological, and chemical disease management practices.
- Apply integrated and molecular strategies for plant disease control effectively.
- Analyze the properties and action mechanisms of antifungal, antibacterial, and antiviral chemicals.
- Implement appropriate methods for applying chemicals to plants and soil while using adjuvants.
- Assess the impact of chemical use on health, the environment, and implement safety measures

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: II
Credits: 3 Theory: 1 Practical: 0		Subject: Plant Pathology
Course Code: PL PATH 508		Title: Epidemiology and Forecasting of Plant Diseases
Course Objectives: ➤ To acquaint with the principles of epidemiology and its application in disease forecasting. ➤ To understand the fundamental concepts and historical development of plant disease epidemics. ➤ To explore modelling approaches and analytical techniques for studying plant disease dynamics. ➤ To develop skills for applying epidemiological principles in disease management and crop loss assessment.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 01 T: 01 P: 01(In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 0 Hrs.=0 Credit (1Hrs./Week=1Credits)		
Practical	Contents	No. of Lectures Allotted
I	Epidemic concepts, simple interest and compound interest disease, historical development.	6
II	Elements of epidemics and their interaction. Structures and patterns of epidemics. Modelling, system approaches and expert systems in plant pathology.	6
III	Genetics of epidemics. Models for development of plant disease epidemics. Common and natural logarithms, function fitting, area under disease progress curve and correction factors, inoculum dynamics. Population biology of pathogens, temporal and spatial variability in plant pathogens.	6
IV	Epidemiological basis of disease management. Survey, surveillance and vigilance.	6
V	Remote sensing techniques and image analysis. Crop loss assessment.	6

Suggested Readings:

- Campbell CL and Madden LV. 1990. Introduction to Plant Disease Epidemiology. John Wiley & Sons, New York
- Cooke B, Jones DM and Gereth KB. 2018 The Epidemiology of Plant Diseases. Springer Publications.
- Cowling EB and Horsefall JG. 1978. Plant Disease. vol. 11. Academic Press, New York.
- Laurence VM, Gareth H and Frame Van den Bosch (Eds.). The Study of Plant Disease Epidemics. APS, St. Paul, Minnesota.
- Nagarajan S and Murlidharan K. 1995. Dynamics of Plant Diseases. Allied Publ., New Delhi.
- Thresh JM. 2006. Plant Virus Epidemiology. Advances in Virus Research 67, Academic Press, New York.
- Van der Plank J E. 1963. Plant Diseases Epidemics and Control. Academic Press, New York.
- Zadoks JC and Schein RD. 1979. Epidemiology and Plant Disease Management. Oxford Univ. Press, London.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
• Apply the principles of epidemic modeling and data analysis to understand plant disease dynamics. • Evaluate temporal and spatial variability of pathogens and its impact on crop health. • Implement surveillance and remote sensing techniques for effective disease management.	

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Plant Pathology
Course Code: PL PATH 511		Title: Chemicals and Botanicals in Plant Disease Management
Course Objectives: ➤ To provide knowledge on the concepts, principles and judicious use of chemicals and botanicals in plant disease management. ➤ Introduce the history and evolution of chemicals used in plant disease management. ➤ Provide an understanding of pesticide classifications and their characteristics. ➤ Explore the roles and applications of fungicides, bactericides, nematocides, and botanicals in plant disease control. ➤ Emphasize the safe handling, storage, and environmental considerations of fungicides and pesticides. ➤ Analyze advancements in new-generation fungicides, botanicals, and their efficacy in disease management		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 1 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Practical	Contents	No. of Lectures Allotted
I	History and development of chemicals; definition of pesticides and related terms; advantages and disadvantages of chemicals and botanicals.	
II	Classification of chemicals used in plant disease management and their characteristics.	
III	Chemicals in plant disease control, viz., fungicides, bactericides, nematocides, antiviral chemicals and botanicals. Issues related to label claim.	
IV	Formulations, mode of action and application of different fungicides; chemotherapy and phytotoxicity of fungicides.	
V	Handling, storage and precautions to be taken while using fungicides; compatibility with other agrochemicals, persistence, cost-benefit ratio, factor affecting fungicides. New generation fungicides and composite formulations of pesticides. Efficacy of different botanicals used and their mode of action. Important botanicals used against diseases. General account of plant protection appliances; environmental pollution, residues and health hazards, fungicidal resistance in plant pathogens and its management.	

Practical

- Acquaintance with formulation of different fungicides and plant protection appliances;
- Formulation of fungicides, bactericides and nematocides;
- In-vitro evaluation techniques, preparation of different concentrations of chemicals including botanical pesticides against pathogens; Persistence, compatibility with other agro-chemicals;
- Detection of naturally occurring fungicide resistant mutants of pathogen; Methods of application of chemicals.

Suggested Readings:

- Bindra OS and Singh H. 1977. Pesticides —And Application Equipment. Oxford & IBH, New Delhi. Nene YL and Thapliyal PN. 1993. Fungicides in Plant Disease Control. 3rd edn. Oxford & IBH, New Delhi.
- Torgeson DC. (Ed.). 1969. Fungicides. Vol. II. An Advanced Treatise. Academic Press, New York. vyas SC. 1993. Handbook of Systemic Fungicides. vols. 1-111. Tata McGraw Hill, New Delhi.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

- Recognize the historical context and definitions related to pesticides and their usage.
- Differentiate between chemical classes and understand their applications in plant disease control.
- Assess the mode of action, formulation, and compatibility of various fungicides and botanicals.
- Identify safe practices and evaluate the environmental and health implications of pesticide use.
- Apply knowledge of modern plant protection techniques and manage fungicidal resistance in pathogens.

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: II
Credits: 3		Subject: Plant Pathology
Theory: 2		
Practical: 1		
Course Code: SST 714		Title: Seed Pathology
Course Objectives: ➤ To acquaint the students with principles and practices of seed health testing and management of seed borne diseases. ➤ To analyze the impact of seed-borne diseases on agriculture and health, along with management strategies. ➤ To learn advanced techniques for seed health testing and healthy seed production.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Practical	Contents	No. of Lectures Allotted
I	History and economic importance of seed pathology in seed industry and plant quarantine; terminology, important seed transmitted pathogens; seed microbes and their mode of action, detection techniques and identification of common seed borne pathogens.	7
II	Morphology and anatomy of typical monocotyledonous and dicotyledonous seeds; mode and mechanism of transmission of seed borne pathogens and microorganisms. Rate of transmission of major plant pathogens, microorganisms in relation to seed certification and tolerance limit; type of losses caused by seed- borne diseases.	9
III	Role of microorganisms in seed quality deterioration; management of seedborne plant pathogens/diseases and procedure for healthy seed production; different seed health testing methods for detecting microorganisms; treatments to control seed borne diseases.	9
IV	Pest Risk Analysis (PRA) and disease free seed production, Sanitary & Phytosaintory (SPS) requirements in seed trade, International regulation (ISHI) in respect of seed health standards.	7
Practical ➤ Different methods of examination of seeds to assess seed-borne microorganisms and to quantify infection percentage, detection of seedborne fungi, bacteria and viruses, ➤ Identification of storage fungi, control of seed borne diseases, seed treatment methods.		

Suggested Readings:

- Agarwal VK and Sinclair JB. 1993. Principles of Seed Pathology. vols. 1 & 11, CBS Publ., New Delhi.
- Hutchins JD and Reeves JE. (Eds.). 1997. Seed Health Testing: Progress Towards the 21st Century. CABI, Wallington.
- Paul Neergaard. 1988. Seed Pathology. McMillan, London.
- Suryanarayana D. 1978. Seed Pathology. Vikash Publ., New Delhi.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

- Demonstrate knowledge of the role of seed pathology in agriculture and global trade.
- Identify and describe seed infection mechanisms and seed-to-plant transmission pathways.
- Evaluate epidemiological factors and predict disease outbreaks from seed-borne pathogens.
- Apply management strategies for controlling seed-borne diseases and producing healthy seeds.
- Perform seed health testing using modern detection methods.

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: II
Credits: 3		Subject: Plant Pathology
Theory: 2		
Practical: 1		
Course Code: STAT 511		Title: Experimental Designs
Course Objectives: • Basic concepts of Experiments, designs and analysis of covariance • Comparative experiments, need for designing of experiments • In depth knowledge of principles of design of experiment: randomization, replication and local control • Knowledge of completely randomized design, Randomized Block Design and Latin square design and their analysis of variance • Balanced Incomplete Block Design (BIBD) and its parameters • Analysis of missing plot design (Fisher’s Rule),analysis of Randomized Block Design with one missing observation		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L:02 T:00 P: 01 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Need for designing of experiments, characteristics of a good design. Basic principles of designs- randomization, replication and local control	8
II	Uniformity trials, size and shape of plots and blocks, Analysis of variance, completely randomized design, randomized block design and Latin square design.	8
III	Factorial experiments, (symmetrical as well as asymmetrical). Orthogonally and partitioning of degrees of freedom. Concept of confounding.	8
IV	Split plot and strip plot designs, analysis of covariance and missing plot techniques in randomized block and Latin square designs; Transformations, Balanced Incomplete Block Design, resolvable designs and their applications, Lattice design, alpha design - concepts, randomization procedure, analysis and interpretation of results. Response surfaces. Combined analysis.	8
Reference / Text Books: • Cochran WG and Cox GM. 1957. <i>Experimental Designs</i>. 2nd Ed. John Wiley. • Dean AM and Voss D. 1999. <i>Design and Analysis of Experiments</i>. Springer. • Montgomery DC. 2012. <i>Design and Analysis of Experiments</i>, 8th Ed. John Wiley.		

- Federer WT. 1985. *Experimental Designs*. MacMillan.
- Fisher RA. 1953. *Design and Analysis of Experiments*. Oliver & Boyd.
- Nigam AK and Gupta VK. 1979. *Handbook on Analysis of Agricultural Experiments*. IASRI Publ.
- Pearce SC. 1983. *The Agricultural Field Experiment: A Statistical Examination of Theory and Practice*. John Wiley.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: • Students will have basic knowledge of Experiments, designs and analysis of covariance • Students will have knowledge of Comparative experiments. • The students will be able to prepare their experimental fields on the basis of designs. • Students can have the knowledge of completely Randomized Design, Randomized Block Design and Latin square design and their analysis of variance. • Students can analyze their results according to the designs.	

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: II
Credits: 1 Theory: 1 Practical: 0		Subject: Plant Pathology
Course Code: PGS 503		Title: Intellectual Property and its Management in Agriculture
Course Objectives: • Knowledge, concept and introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement • Basics of Legislations for the protection of various types of Intellectual Properties • Fundamentals of patents, copyrights, geographical indications, designs and layout • Basic concepts of Protection of plant varieties and farmers' rights and bio-diversity protection, Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture • Study of Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 1, Practical- 0, Total Credits- 1		
L: 01 T: 00 P: 00 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 0 Hrs.=0 Credit (1Hr./Week=1Credits)		
Unit	Contents	No. of Lectures Allotted
I	Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs;	4
II	Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection.	4
III	Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity.	4
IV	International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.	4
Reference / Text Books:		

- Erbisch FH and Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.
- Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.
- Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
- Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI.
- Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
- The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; The Biological Diversity Act, 2002.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

1. Concept of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement.
2. Knowledge of Legislations for the protection of various types of Intellectual Properties.
3. Concepts of Protection of plant varieties and farmers' rights and bio-diversity protection, Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture.
4. Knowledge of Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture.
5. Knowledge of Socio-economic impact, Research collaboration Agreement, License Agreement.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: II
Credits: 1 Theory: 1 Practical: 0		Subject: Plant Pathology
Course Code: PGS 505		Title: Agricultural Research, Research Ethics and Rural Development Programmes
Course Objectives: 1. Appreciate the objective and principle of extension education 2. Obtain idea on various development programmes in agriculture and allied area to help farmers. 3. To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60%, Theory- 1, Practical- 0, Total Credits- 1		
L:01 T:00 P: 00 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 0 Hrs.=0 Credit (1Hr./Week=1 Credits)		
Unit	Contents	No. of Lectures Allotted
I	History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR):	6
II	International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.	6
III	Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.	6
IV	Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme,	6
V	Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/ Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in	6

implementation of rural policies and programmes.	
Reference / Text Books: • Bhalla GS and Singh G. 2001. <i>Indian Agriculture - Four Decades of Development</i>. Sage Publ. • Punia MS. <i>Manual on International Research and Research Ethics</i>. CCS Haryana Agricultural University, Hisar. • Rao BSV. 2007. <i>Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives</i>. Mittal Publ. • Singh K. 1998. <i>Rural Development - Principles, Policies and Management</i>. Sage Publ.	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks / Sessional Examination	30
2. Presentations / Seminar / Assignments / internal Practical / Research Project Report / Seminar On Research Project Report	20
3. ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: 1. Students capable, efficient and self-reliant in character. 2. They gain knowledge to help rural families in better appreciation of SWOT in the village. 3. They know about to open new opportunities for developing talents and leadership of rural people. 4. To provide knowledge and help for better management of farms and increase incomes. 5. To promote better social, natural recreational intellectual and spiritual file among the people.	

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Plant Pathology		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Plant Pathology
Course Code: PL PAT 515		Title: Diseases of Field and Medicinal Crops
Course Objectives: ➤ To identify and understand the diseases affecting cereal, pulse, oilseed, cash, fodder legume, and medicinal crops. ➤ To explore the symptoms, causes, and management strategies for diseases in various crop groups. ➤ To study the impact of plant diseases on crop yield and quality across different agricultural sectors.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Practical	Contents	No. of Lectures Allotted
I	Diseases of Cereal crops- Rice, wheat, barley, pearl millet, sorghum and maize.	6
II	Diseases of Pulse crops- Gram, urdbean, mungbean, lentil, pigeonpea, soybean and cowpea.	6
III	Diseases of Oilseed crops- Rapeseed and mustard, sesame, linseed, sunflower, groundnut, castor.	6
IV	Diseases of Cash crops-Cotton, sugarcane. Diseases of Fodder legume crops- Berseem, oats, guar, lucerne.	6
V	Medicinal crops- Plantago, liquorice, mulathi, rosagrass, sacred basil, mentha, ashwagandha, Aloe vera.	6
Practical ➤ Detailed study of symptoms and host parasite relationship of important diseases of above-mentioned crops; Collection and dry preservation of diseased specimens of important crops.		
Suggested Readings: ➤ Joshi LM, Singh DV and Srivastava KD. 1984. Problems and Progress of Wheat Pathology in South Asia. Malhotra Publ. House, New Delhi. ➤ Rangaswami G. 1999. Diseases of Crop Plants in India. 4th Ed. Prentice Hall of India, New Delhi. ➤ Ricanel C, Egan BT, Gillaspie Jr AG and Hughes CG. 1989. Diseases of Sugarcane, Major Diseases. Academic Press, New York.		

- Singh RS. 2017. Plant Diseases. 10th Ed. Medtech, New Delhi.
- Singh US, Mukhopadhyay AN, Kumar J and Chaube HS. 1992. Plant Diseases of International Importance. Vol. I. Diseases of Cereals and Pulses. Prentice Hall, Englewood Cliffs, New Jersey.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
• Recognize and describe the key diseases of cereal, pulse, oilseed, and other crop categories. • Analyze the symptoms, etiology, and management techniques for diseases in a range of crops. • Apply effective disease management strategies to improve crop health and productivity in diverse agricultural systems	

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.	Year: II	
Class: M. Sc. (Ag) Plant Pathology	Semester: III	
Credits: 3	Subject: Plant Pathology	
Theory: 2		
Practical: 1		
Course Code: PL PAT 515	Title: Diseases of Fruits, Plantation and Ornamental Crops	
Course Objectives: ➤ To acquaint with diseases of fruits, plantation, ornamental plants and their management. ➤ To understand the symptoms, etiology, and management of diseases in various fruit crops. ➤ To explore the diseases affecting plantation and ornamental crops, including their symptoms and management strategies. ➤ To study the factors influencing disease development and the life cycle of pathogens in fruit and ornamental plants.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Practical	Contents	No. of Lectures Allotted
I	Introduction, symptoms and etiology of different fruit diseases. Factors affecting disease development in fruits like apple, pear, peach, plum, apricot, cherry, walnut, almond, strawberry, citrus, mango, grapes, guava, ber, banana, pineapple, papaya, fig, pomegranate, date palm, custard apple and their management.	
II	Symptoms, mode of perpetuation of diseases of plantation crops such as tea, coffee, rubber and coconut and their management.	
III	Symptoms and life cycle of pathogens. Factors affecting disease development of ornamental plants such as roses, gladiolus, tulip, carnation, gerbera orchids, marigold, chrysanthemum and their management.	
Practical ➤ Detailed study of symptoms and host parasite relationship of representative diseases of plantation crops; ➤ Collection and dry preservation of diseased specimens of important crops.		

Suggested Readings:

- Gupta VK and Sharma SK. 2000. Diseases of Fruit Crops. Kalyani Publishers, New Delhi.
- Pathak VN. 1980. Diseases of Fruit Crops. Oxford & IBH, New Delhi.
- Singh RS. 2000. Diseases of Fruit Crops. Oxford & IBH, New Delhi. Walker JC. 2004. Diseases of Vegetable Crops. TTPP, India.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

- Identify and explain the symptoms and causes of diseases in fruit crops, and apply effective management practices.
- Analyze the impact of diseases on plantation crops and ornamental plants, and propose suitable control measures.
- Understand the life cycle of pathogens and the factors influencing disease development in diverse plant species.

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Plant Pathology		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Plant Pathology
Course Code: PL PATH 517		Title: Diseases of Vegetable and Spices Crops
Course Objectives: ➤ To impart knowledge about symptoms, epidemiology of different diseases of vegetables and spices and their management. ➤ To understand the nature, prevalence, and factors affecting disease development in various vegetable crops. ➤ To explore the symptoms and management of diseases in root, tuber, bulb, and other vegetable crops. ➤ To study the epidemiology, symptoms, and management of diseases in spice crops, and the application of biotechnology in disease resistance.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Practical	Contents	No. of Lectures Allotted
I	Nature, prevalence, factors affecting disease development of tuber, bulb, leafy vegetable, crucifers, cucurbits and solanaceous vegetables. Diseases of crops under protected cultivation.	8
II	Symptoms and management of diseases of different root, tuber, bulb, leafy vegetables, crucifers, cucurbits and solanaceous vegetable crops.	8
III	Symptoms, epidemiology and management of diseases of different spice crops such as black pepper, nutmeg, saffron, cumin, coriander, turmeric, fennel, fenugreek and ginger. Biotechnological approaches in developing disease resistant transgenics.	8
Practical ➤ Detailed study of symptoms and host pathogen interaction of important diseases of vegetable and spice crops.		
Suggested Readings: ➤ Chaube HS, Singh US, Mukhopadhyay AN and Kumar J. 1992. Plant Diseases of International Importance. Vol. II. Diseases of Vegetable and Oilseed Crops. Prentice Hall, Englewood Cliffs, New Jersey. ➤ Gupta VK and Paul YS. 2001. Diseases of Vegetable Crops. Kalyani Publishers, New Delhi		

- Gupta SK and Thind TS. 2006. Disease Problem in Vegetable Production. Scientific Publ., Jodhpur. Sherf AF and McNab AA. 1986. Vegetable Diseases and their Control. Wiley Inter Science, Columbia.
- Singh RS. 1999. Diseases of Vegetable Crops. Oxford & IBH, New Delhi. Walker JC. 1952. Diseases of Vegetable Crops. McGraw-Hill, New York.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
• Demonstrate knowledge of disease prevalence and factors affecting vegetable crop diseases. • Identify symptoms and apply management strategies for diseases in various vegetable crops. • Understand and apply biotechnological approaches for disease resistance in spice crops.	

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Plant Pathology		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Plant Pathology
Course Code: ENTO0509		Title: Pests of Field Crops
Course Objectives: ➤ To familiarize the students about nature of damage and seasonal incidence of pestiferous insects that cause loss to major field crops and their effective management by different methods.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Practical	Contents	No. of Lectures Allotted
I	Systematic position, identification, distribution, host-range, bionomics, nature and extent of damage, seasonal abundance and management of insect and mite pests and vectors. Insect pest scenario in relation to climate change.	8
II	Polyphagous pests: grasshoppers, locusts, termites, white grubs, hairy caterpillars, and non- insect pests (mites, birds, rodents, snails, slugs etc.). Insect pests of cereals and millets and their management.	8
III	Insect pests of pulses, tobacco, oilseeds and their management.	8
IV	Insect pests of fibre crops, forage crops, sugarcane and their management.	8
Practical ➤ Field visits, collection and identification of important pests and their natural enemies ➤ Detection and estimation of infestation and losses in different crops; study of life history of important insect pests.		
Suggested Readings: ➤ David, BV and Ramamurthy, VV. 2001. Elements of Economic Entomology. Popular Book Depot, Chennai. ➤ Dhaliwal GS, Singh R and Chhillar BS. 2006. Essentials of Agricultural Entomology. Kalyani Publ., New Delhi. ➤ Dunston AP. 2007. The Insects: Beneficial and Harmful Aspects. Kalyani Publ., New Delhi ➤ Evans JW. 2005. Insect Pests and their Control. Asiatic Publ., New Delhi. ➤ Nair MRGK. 1986. Insect and Mites of Crops in India. ICAR, New Delhi. Prakash I ➤ and Mathur RP. 1987. Management of Rodent Pests. ICAR, New Delhi. ➤ Saxena RC and Srivastava RC. 2007. Entomology at a Glance. Agrotech Publ. Academy		

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Course Learning Outcomes:	
- Identify the systematic position, distribution, and bionomics of insect and mite pests. - Analyze the nature, extent of damage, and seasonal abundance of major pests. - Understand the impact of climate change on pest scenarios and management strategies. - Develop management techniques for pests of cereals, millets, pulses, tobacco, oilseeds, and fibre crops. - Address challenges posed by polyphagous pests and non-insect pests like mites, birds, and rodents.	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Plant Pathology		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Plant Pathology
Course Code: GPB-501		Title: Principles of Genetics
Course Objectives: ➤ This course is aimed at understanding the basic concepts of genetics, helping students to develop their analytical, quantitative and problem-solving skills from classical to molecular genetics.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Practical	Contents	No. of Lectures Allotted
I	Beginning of genetics; Cell structure and cell division; Early concepts of inheritance, Mendel's laws; Discussion on Mendel's paper, Chromosomal theory of inheritance. Multiple alleles, Gene interactions. Sex determination, differentiation and sex-linkage, Sexinfluenced and sex-limited traits; Linkage-detection, estimation; Recombination and genetic mapping in eukaryotes, Somatic cell genetics, Extra chromosomal inheritance.	6
II	Population - Mendelian population – Random mating population - Frequencies of genes and genotypes-Causes of change: Hardy-Weinberg equilibrium. Structural and numerical changes in chromosomes; Nature, structure and replication of the genetic material; Organization of DNA in chromosomes, Genetic code; Protein biosynthesis.	6
III	Genetic fine structure analysis, Allelic complementation, Split genes, Transposable genetic elements, Overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters. Regulation of gene activity in prokaryotes; Molecular mechanisms of mutation, repair and suppression; Bacterial plasmids, insertion (IS) and transposable (Tn) elements; Molecular chaperones and gene expression. Gene regulation in eukaryotes, RNA editing.	6
IV	Gene isolation, synthesis and cloning, genomic and cDNA libraries, PCR based cloning, positional cloning; Nucleic acid hybridization and immunochemical detection; DNA sequencing; DNA restriction and modification, Anti-sense RNA and ribozymes; Micro RNAs (miRNAs), Genomics and proteomics; Functional and pharmacogenomics; Metagenomics	6

V	Methods of studying polymorphism at biochemical and DNA level; Transgenic bacteria and bioethics; Gene silencing; genetics of mitochondria and chloroplasts, Concepts of Eugenics, Epigenetics, Genetic disorders and Behavioural genetics.	6
Practical ➤ Laboratory exercises in probability and chi-square; Demonstration of genetic principles using laboratory organisms; Chromosome mapping using three-point test cross; Tetrad analysis; Induction and detection of mutations through genetic tests; DNA extraction and ➤ PCR amplification- Electrophoresis- basic principles and running of amplified ➤ DNA Extraction of proteins and isozymes- use of Agrobacterium mediated method and Biolistic gun; practical demonstrations- Detection of transgenes in the exposed plant material; visit to transgenic glasshouse and learning the practical considerations.		
Suggested Readings: ➤ Gardner EJ & Snustad DP. 1991. Principles of Genetics. John Wiley & Sons. ➤ Klug WS & Cummings MR. 2003. Concepts of Genetics. Peterson Edu. ➤ Lewin B. 2008. Genes IX. Jones & Bartlett Publ. ➤ Russell PJ. 1998. Genetics. The Benzamin/Cummings Publ. Co. ➤ Snustad DP & Simmons MJ. 2006. Genetics. 4th Ed. John Wiley & Sons. ➤ Strickberger MW. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India ➤ Tamarin RH. 1999. Principles of Genetics. Wm. C. Brown Publs. ➤ Uppal S, Yadav R, Subhadra & Saharan RP. 2005. Practical Manual on ➤ Basic and Applied Genetics. Dept. of Genetics, CCS HAU Hisar		
If the course is available as Generic Elective, then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1. Class tasks / Sessional Examination		30
2. Presentations / Seminar / Assignments / internal Practical / Research Project Report / Seminar On Research Project Report		20
3. ESE		50
Total:		100
Course Learning Outcomes: • Understand fundamental principles of genetics, including Mendel's laws, chromosomal theory, and gene interactions. • Explore genetic mapping, recombination, and extra-chromosomal inheritance in eukaryotes. • Analyze population genetics, Hardy-Weinberg equilibrium, and factors causing genetic variation. • Investigate molecular mechanisms of mutation, gene regulation, and DNA replication and repair. • Apply advanced genetic techniques like cloning, genomic analysis, and study of transgenic organisms and bioethics.		

Format-3

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Plant Pathology		Semester: III
Credits: 1 Theory: 0 Practical: 1		Subject: Plant Pathology
Course Code: PGS-501		Title: Library And Information Services
Course Objectives: • Knowledge and concept of different techniques of crop production • Basics of crop growth in relation to environment and sustainability • Knowledge of tillage (zero and minimum tillage) • Basic concepts of crop modelling for maximizing crop yield • Study of Cropping and farming systems for sustainable agriculture		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 0, Practical- 1, Total Credits- 1		
L: 0 T: 0 P: 01(In Hours/Week) Theory - 0 Hr. = 0 Credit Practical- 02 Hrs.=01 Credit (2Hrs./Week=1Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to library and its services; Role of libraries in education, research and technology transfer. Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources. Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.)Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography, Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods	15
Suggested Readings: 1. Chhidda Singh, Modern techniques of raising field crops. Oxford and IBH Publishing Co. Ltd., Bangalore. 2. Gopal Chandra De. 1980., Fundamentals of Agronomy. Oxford and IBH Publishing Co. Ltd., Bangalore, Hand book of Agriculture, ICAR Publication. 3. Palaniappan, S.P., Cropping Systems in the tropics – Principles and Practices. Willey Eastern Ltd., New Delhi. Panda, S.C., 2006.Agronomy Agribios Publication, New Delhi.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		Max. Marks

1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal	
3. Practical/Research Project Report/Seminar On Research Project Report	20
4. ESE	50
Total:	100
Course Learning Outcomes: - To acquaint students with the basic concepts of information and information science. - To understand the concept communication of information, models of communication and role of libraries in information communication in society. - To make students understand and appreciate the concept of information society and information policies formulated for societal development. - To get familiarize with the concepts of economics and management of information and knowledge	

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Plant Pathology		Semester: III
Credits: 1 Theory: 0 Practical: 1		Subject: Plant Pathology
Course Code: PGS-502		Title: Technical Writing and Communications Skills
Course Objectives: • Knowledge and concept of different techniques of crop production • Basics of crop growth in relation to environment and sustainability • Knowledge of tillage (zero and minimum tillage) • Basic concepts of crop modelling for maximizing crop yield • Study of Cropping and farming systems for sustainable agriculture		
Nature of Paper: Common course		
Minimum Passing Marks/Credits: 60%, Theory- 0, Practical- 1, Total Credits- 1		
L: 0 T: 0 P: 01(In Hours/Week) Theory - 1 Hr. = 1Credit Practical- 2 Hrs.=1 Credit (2Hrs./Week=1Credits)		
Unit	Contents	No. of Lectures Allotted
I	Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc.; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article. Communication Skills-Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors) Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers	
Suggested Readings: 1. Chicago Manual of Style. 14thEd. 1996. Prentice Hall of India. 2. Collins' Co-build English Dictionary. 1995. Harper Collins. 3. Gordon HM & Walter JA. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston. 4. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press.		

5. James HS. 1994. Handbook for Technical Writing. NTC Business Books. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations / Seminar / Assignments / internal Practical / Practical / Research Project Report / Seminar On Research Project Report	20
3) ESE	50
Total:	100
Course Learning Outcomes: • Learn in-demand skills from university and industry experts • Master a subject or tool with hands-on projects • Develop a deep understanding of key concepts • Earn a career certificate from University of Colorado Boulder	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.	Year: I	
Class: M. Sc. (Ag) Plant Pathology	Semester: I	
Credits: 3 Theory: 2 Practical: 1	Subject: Plant Pathology	
Course Code: PL PATH 504*	Title: Plant Nematology	
Course Objectives: • To understand the characteristics, classification, and diversity of nematodes and their relationships with other phyla. • To explore the economic importance of nematodes in agriculture, horticulture, and forestry. • To learn about the morphology, biology, and ecology of plant-parasitic nematodes. • To analyze the interaction of nematodes with plants and other organisms and the resulting damage. • To gain knowledge on principles, practices, and strategies for integrated nematode management.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60%, Theory- 2, Practical- 1, Total Credits- 3		
L: 02 T: 01 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Characteristics of Phylum Nematoda and its relationship with other related phyla, history and growth of Nematology; nematode habitats and diversity-plant, animal and human parasites; useful nematodes; economic importance of nematodes to agriculture, horticulture and forestry.	6
II	Gross morphology of plant parasitic nematodes; broad classification, nematode biology, physiology and ecology.	6
III	Types of parasitism; nature of damage and general symptomatology; interaction of plant-parasitic nematodes with other organisms.	6
IV	Plant nematode relationships, cellular responses to infection by important phytonematodes; physiological specialization among phytonematodes.	6
V	Principles and practices of nematode management; integrated nematode management. Emerging nematode problems, Importance of nematodes in international trade and quarantine	6
Practical ➤ Studies on kinds of nematodes- free-living, animal, insect and plant parasites;. Nematode extraction from soil; ➤ Extraction of migratory endoparasites, staining for sedentary endoparasites; ➤ Examination of different life stages of important plant parasitic nematodes, their symptoms and histopathology.		

Suggested Readings:

- Dropkin VH. 1980. An Introduction to Plant Nematology. John Wiley & Sons, New York.
- Maggenti AR. 1981. General Nematology. Springer-Verlag, New York.
- Perry RN and Moens M. 2013. Plant Nematology. 2nd Ed. CABI Publishing: Wallingford, UK.
- Perry RN, Moens M, and Starr JL. 2009. Root-knot nematodes, CABI Publishing: Wallingford, UK.
- Sikora RA, Coyne D, Hallman J and Timper P. 2018. Plant Parasitic Nematodes in Subtropical and Tropical Agriculture. 3rd edn. CABI Publishing, England.
- Thorne G. 1961. Principles of Nematology. McGraw Hill, New Delhi.
- Walia RK and Bajaj HR. 2003. Text Book on Introductory Plant Nematology. ICAR, New Delhi.
- Walia RK and Khan MR. 2018. A Compendium of Nematode Diseases of Crop Plants, ICARAICRP (Nematodes), IARI, New Delhi.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Course Learning Outcomes:

- Students will identify and classify nematodes and their habitats.
- Students will evaluate the economic impact of nematodes in various sectors.
- Students will describe nematode biology, physiology, and their parasitic nature.
- Students will assess plant-nematode interactions and the cellular responses involved.
- Students will apply integrated management practices to control nematode problems.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Plant Pathology		Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Plant Pathology
Course Code: MCA 512		Title: Information Technology in Agriculture
Course Objectives: This is a course on Introduction to Networking and Internet Applications that aims at exposing the students to understand analogy of computer, basic knowledge of MS Office. Also to understand Internet and WWW, use of IT application and different IT tools in Agriculture		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 1, Practical 1 = 2 Credits		
L:01 T:00 P: 01 (In Hours/Week) Theory - 1 Hr. = 1 Credit Practical- 2 Hrs.=1 Credit (3Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction to Computers, Anatomy of computer, Operating Systems, definition and types, Applications of MS Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions	3
II	Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components, Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications.	3
III	Use of ICT in Agriculture, Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management <i>etc.</i> .	3
IV	Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems <i>etc.</i> for supporting Farm decisions, Preparation of contingent crop-planning using IT tools.	3
Reference / Text Books: - Internet: The Complete Reference - Sub Edition by Margaret Levine Young. - Office 2013 All-In-One For Dummies by Peter Weverka. - Computer Fundamentals (With CD) 6th Edition 6th Edition by Pradeep Sinha and Priti Sinha.		

- Principles of Programming Languages by Er. Anil Panghal.
- E-Agriculture and Rural Development by Charalampos Patrikakis, Blessing Maumbe.
- Vanitha G. 2011. *Agro-informatics*
- <http://www.agrimoon.com>
- <http://www.agriinfo.in>
- <http://www.eagri.org>
- <http://www.agriglance.com>

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- Increased employability of agricultural graduates
- Trained and skilled manpower
- High level of interface with the industry
- Knowledge platform with the domestic and international intelligentsia
- Producing managers & social entrepreneurs
- Improved crop productivity & farm profitability

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate / Diploma/ Degree/ UG/PG/PhD		Year: I
Class: M. Sc. (Ag.) Plant Pathology		Semester: I
Credits: 1 Theory: 1 Practical: 0		Subject: Plant Pathology
Course Code: PGS-506		Title: (e-course) DISASTER MANAGEMENT
Course Objectives: - To provide basic conceptual understanding of disasters. - To understand approaches of Disaster Management. - To build skills to respond to disaster.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 1, Practical 0 = 1 Credits		
L: 01 T: 00 P: 00 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Content	No. of Lectures Allotted
I	Natural Disasters Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves. Climatic change, Global warming, Sea level rise, Ozone depletion.	3
II	Man Made Disasters-Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents	3
III	Disasters Management- Efforts to mitigate natural disasters at national and global levels. Concept of disaster management, International strategy for disasters reduction.	3
IV	National disaster management framework, financial arrangement, role of NGOs, Community-based organizations and media. Central, state, district and local administration, Armed forces in disaster response, Disaster response: Police and other organizations.	3
Suggested Readings: - Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012) - Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.		

3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/Sessional Examination	30
2) Presentations /Seminar/Assignments/internal	20
3) Practical/Research Project Report/Seminar on Research Project Report	
4) ESE	50
Total:	100
Course Learning Outcomes:	
- Students can learn the basic concepts of disasters and disaster management. - Students can learn to evaluate disaster risk reduction and management principles and practices, - Students can learn about the phenomenon of disaster, its different dimensions, strategies for disaster reduction. - Students can learn about various types of disasters, their causes and impacts on communities.	



Evaluation Scheme

M. Sc (Hort.) in Fruit Science

Year: I / Semester: I

S.No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	FSC-501	Tropical Fruit Production	3	2	1	50	20	30	60	100
2	FSC-502	Subtropical and Temperate Fruit Production	3	2	1	50	20	30	60	100
3	FSC-507	Growth and Development of Horticultural Crops	3	2	1	50	20	30	60	100
4	FSC-508	Nutrition of Fruit Crops	3	2	1	50	20	30	60	100
5	STAT-502	Statistical Methods for Applied Sciences	4	3	1	50	20	30	60	100
6	MCA-511	Introduction to Networking and Internet Applications	2	1	1	50	20	30	60	100
7	PGS-501	Library and Information Services	1	0	1	0	100	0	60	100
8	PGS-503	(e-Course) Intellectual Property and its management in Agriculture	1	1	0	70	0	30	60	100
Total			20	13	7	370	220	210	480	800

Year: I / Semester: II

S.No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	FSC-503	Propagation and nursery management for fruit crops	3	2	1	50	20	30	60	100
2	FSC-504	Breeding of fruit crops	3	2	1	50	20	30	60	100

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3	FSC-509	Biotechnology of Fruit Crops	3	2	1	50	20	30	60	100
4	FSC-511	Export Oriented Fruit Production	3	2	1	50	20	30	60	100
5	VSC-504	Principles of Vegetable Breeding	3	2	1	50	20	30	60	100
6	VSC-512	Production Technology of Spice Crops	3	2	1	50	20	30	60	100
7	PGS-502	Technical Writing and Communications Skills	1	0	1	0	100	0	60	100
8	FSC-591	Master's Seminar	1	0	1	0	0	100	60	100
9	FSC-599	Master's research	10	0	0	0	0	0	0	0
Total			30	12	8	300	220	280	480	800

Year: II / Semester: III

S.No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	FSC-506	Canopy Management in Fruit Crops	2	1	1	50	20	30	60	100
2	FSC-505	Systematic of Fruit Crops	3	2	1	50	20	30	60	100
3	FSC-510	Organic Fruit Culture	3	2	1	50	20	30	60	100
4	VSC-501	Production of Cool Season Vegetable Crops	3	2	1	50	20	30	60	100
5	PGS-504	(e-Course) Basic Concepts in Laboratory Techniques	1	0	1	0	100	0	60	100
6	PGS-505	Agricultural Research, Research Ethics and Rural Development Programmes	1	1	0	70	0	30	60	100
7	FSC-599	Master's research	10	0	0	0	0	0	0	0
Total			23	8	5	270	180	150	360	600



Year: II / Semester: IV

S.No.	Sub. Code	Subject	Credit	Theory	Lab	External Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	FSC-599	Master's research	20	-	-	100	-	-	60	100
Total			20	-	-					100

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: M.Sc. (Hort.) Fruit Science		Year : I Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Horticulture
Course Code: FSC-501		Title: Tropical Fruit Production
Course Objectives: - To impart basic knowledge about the importance and management of Tropical and dry land fruits grown in India. - To know the concept of IPM and recognizing the physiological disorders of fruit plants. - To impart knowledge about inflorescence, pollination and fruit bearing in orchard.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction; Importance and Background: Importance, origin and distribution, major species, rootstocks and commercial varieties of regional, national and international importance, eco-physiological requirements.	6
II	Agro-techniques; Propagation, Planting and Orchard Floor Management: Asexual and sexual methods of propagation, planting systems and planting densities, training and pruning methods, rejuvenation, intercropping, nutrient management, water management, fertigation, use of bio-fertilizers, role of bio-regulators, abiotic factors limiting fruit production.	6
III	Crop Management; Flowering, Fruit-Set and Harvesting: Physiology of flowering, pollination management, fruit set and development, physiological disorders – causes and remedies, crop regulation,	6
IV	Quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; insect and disease management.	6
V	Crops: Mango, Banana, Guava, Pineapple, Papaya, Avocado, Jackfruit, Annonas, Aonla, Ber, etc.	6
Suggested Readings: - Bose TK, Mitra SK and Sanyal D. 2002. Fruits of India – Tropical and Sub-Tropical. 3rd Edn. - Dhillon WS. 2013. Fruit Production in India. Narendra Publ. House, New Delhi.		

3. Iyer CPA and Kurian RM. 2006. High Density Planting in Tropical Fruits: Principles and Practices. IBDC Publishers, New Delhi.
4. Morton JF. 2013. Fruits of Warm Climates. Echo Point Book Media, USA.
5. Nakasome HY and Paull RE. 1998. Tropical Fruits. CAB International.
6. Paull RE and Duarte O. 2011. Tropical Fruits (Vol. 1). CAB International.
7. Sharma KK and Singh NP. 2011. Soil and Orchard Management. Daya Publishing House, New Delhi.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100
Course Learning Outcomes:	
- Students will learn about the importance and management of tropical fruits. - To provide knowledge about IPM, diseases and others physiological disorders effecting fruit production. - Provide knowledge about flowering, pollination and fruit setting in fruit crops.	

IMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.	Year: I	
Class: M.Sc. (Hort.) Fruit Science	Semester: I	
Credits: 3 Theory: 2 Practical: 1	Subject: Horticulture	
Course Code: FSC 502	Title: Subtropical and Temperate Fruit Production	
Course Objectives: 1. To provide basic knowledge about the importance and management of sub-tropical and temperate fruits grown in India. 2. To provide knowledge about IPM, diseases and others physiological disorders effecting fruit production. 3. Provide knowledge about the propagation techniques, planting system, cropping, root zone and canopy management in fruit crops.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction: Importance and Background: Origin, distribution and importance, major species, rootstocks and commercial varieties of regional, national and international importance, eco-physiological requirements	6
II	Agro-Techniques: Propagation, Planting and Orchard Floor Management: Propagation, planting systems and densities, training and pruning, rejuvenation and replanting, intercropping, nutrient management, water management, fertigation, use of bio-fertilizers, role of bio-regulators, abiotic factors limiting fruit production	6
III	Crop Management: Flowering, Fruit-Set and Harvesting: Physiology of flowering, pollination management, fruit set and development, physiological disorders-causes and remedies, crop regulation,	6
IV	Quality management: Quality improvement by management practices; maturity indices, harvesting, grading, packing, storage and ripening techniques; insect and disease management.	6

V	Crops: Citrus, Grapes, Litchi, Pomegranate, Apple, Pear, Peach, Plum, Apricot, Cherries, Berries, Persimmon, Kiwifruit, Nuts- Walnut, Almond, Pecan, etc.	6
Reference / Text Books: 1. Chadha KL and Awasthi RP. 2005. The Apple. Malhotra Publishing House, New Delhi. Chadha TR. 2011. A Text Book of Temperate Fruits. ICAR, New Delhi 2. Childers NF, Morris JR and Sibbett GS. 1995. Modern Fruit Science: Orchard and Small Fruit Culture. Horticultural Publications, USA. 3. Creasy G and Creasy L. 2018. Grapes. CAB International. Davies FS and Albrigo LG. 1994. Citrus. CAB International. 4. Dhillon WS. 2013. Fruit Production in India. Narendra Publishing House, New Delhi. 5. Jackson D, Thiele G, Looney NE and Morley-Bunker M. 2011. Temperate and Subtropical Fruit Production. CAB International. 6. Sharma RR and Krishna H. 2018. Textbook of Temperate Fruits. CBS Publishers and Distributors Pvt. Ltd., New Delhi. 7. Tromp J, Webster AS and Wertheim SJ. 2005. Fundamentals of Temperate Zone Tree Fruit Production. Backhuys Publishers, Lieden, The Netherlands. 8. Westwood MN. 2009. Temperate Zone Pomology: Physiology and Culture. Timber Press, USA.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE		50
Total:		100
Prerequisites for the course:		
Course Learning Outcomes: 1. Students will learn about the importance and management of sub- tropical and temperate fruits. 2. To provide knowledge about IPM, diseases and others physiological disorders effecting fruit production 3. To gain knowledge about the recent trends in propagation, rootstock influence, planting system, cropping systems, root zone and canopy management.		

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M.Sc. (Hort.) Fruit Science		Semester: I
Credits: 3		Subject: Horticulture
Theory: 2		
Practical: 1		
Course Code: FSC 507		Title: Growth and Development of Fruit Crops
Course Objectives: 1. To give students a thorough understanding of the physiological procedures, stages of development, and elements affecting the growth and development of fruit-bearing plants.		
Nature of Paper: Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 0 P: 01 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit(4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction General Concepts and Principles: Growth and development-definition, parameters of growth and development, growth dynamics and morphogenesis.	6
II	Climatic Factors, Hormones and Developmental Physiology: Environmental impact on growth and development-effect of light temperature, photosynthesis and photoperiodism, verbalization, heat units and thermoperiodism.	6
III	Assimilate partitioning, influence of water and mineral nutrition in growth and development; concepts of plant hormone and bioregulators, history, biosynthesis and physiological role of auxins, gibberellins, cytokinins, abscissic acid, ethylene, growth inhibitors and retardant, brassinosteroids, other New PGRs.	6
IV	Developmental physiology and biochemistry during dormancy, bud break, juvenility, vegetative to reproductive interphase, flowering, pollination, fertilization and fruit set, fruit drop, fruit growth, ripening and seed development.	6
V	Strategies for Overcoming Stress: Growth and developmental process during stress – manipulation of growth and development, impact of pruning and training, chemical manipulations and Commercial application of PGRs in fruit crops, molecular and genetic approaches in plant growth and development.	6

Reference / Text Books

- Bhatnagar P. 2017. Physiology of Growth and Development of Horticultural Crops. Agrobios (India).
- Roberts J, Downs S and Parker P. 2002. Plant Growth Development. In: Salisbury FB and Ross CW. (Eds.) Plant Physiology. 4th Ed. Wadsworth Publications, USA.
- Schafeer, B. and Anderson, P. 1994. Handbook of Environmental Physiology of Fruit Crops. Vol. 1 & 2. CRC Press. USA.
- Seymour GB, Taylor JE and Tucker GA. 1993. Biochemistry of Fruit Ripening. Chapman & Hall, London.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

Consequent upon successful completion of the course, the students are expected to have

CO1: Equipped with understanding of various growth and development processes

CO2: Students will understand the biochemical, physiological, genetic and molecular mechanisms during different developmental phases of horticultural crops as well as students will thoroughly understand the various bio-synthetic pathways of plant hormones

CO3: Students will be able apply the principles learnt in previous units in field level and able to assess the influence on growth pattern of crops during stressful situations.

CO4: Students will be able to analyse the impact of physical and chemical manipulation of growth and development.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M.Sc. (Hort.) Fruit Science		Semester: I
Credits: 3		Subject: Horticulture
Theory: 2		
Practical: 1		
Course Code: FSC 508		Title: Nutrition of Fruit Crops
Course Objectives: 1. To give students a thorough understanding of fruit-bearing plants' nutritional needs as well as the elements that affect how well those nutrients are taken in, assimilated, and used. 2. This course's goals include managing nutrient functions, soil-plant interactions, nutrient deficiencies and toxicities, fertilizer management, and nutrient essentials.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L:2 T: 0 P: 1(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction General Concepts and Principles: Importance and history of nutrition in fruit crops, essential plant nutrients, factors affecting plant nutrition; nutrient uptake and their removal from soil.	8
II	Diagnostics, Estimation and Application: Nutrient requirements, root distribution in fruit crops, soil and foliar application of nutrients in major fruit crops, fertilizer use efficiency. Methods and techniques for evaluating the requirement of macro- and micro-elements,	8
III	Diagnostic and interpretation techniques including DRIS. Role of different macro- and micro-nutrients, their deficiency and to Xicity disorders, corrective measures to overcome deficiency and to Xicity disorders.	8
IV	Integrated Nutrient Management (INM): Fertigation in fruit crops, bio-fertilizers and their use in INM systems.	8
Reference / Text Books: • Atkinson D, Jackson JE and Sharples RO. 1980. Mineral Nutrition of Fruit Trees. Butterworth Heinemann. • Bould C, Hewitt EJ and Needham P. 1983. Diagnosis of Mineral Disorders in Plants Vol.1 Principles. Her Majesty’s Stationery Office, London. • Cooke GW. 1972. Fertilizers for maximizing yield. Grenada Publishing Ltd, London. • Mengel K and Kirkby EA. 1987. Principles of Plant Nutrition. 4th Ed. International Potash		

Institute, Worblaufen-Bern, Switzerland.

- Tandon HLS. 1992. Management of Nutrient Interactions in Agriculture. Fertilizer Development and Consultation Organization, New Delhi.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

CO1: Know the importance and various types of nutrients and their uptake mechanisms

CO2: Analyse soil and plant status with respect to various nutrients

CO3: Make use of corrective measures to overcome deficiency or toxicity

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M.Sc. (Hort.) Fruit Science		Semester: II
Credits: 3		Subject: Horticulture
Theory: 2		
Practical: 1		
Course Code: FSC 503		Title: Propagation and Nursery Management in Fruit Crops
Course Objectives: 1. To impart knowledge to the students on plant propagation by sexual and asexual method of propagation 2. To impart knowledge to the students on physiological and anatomical aspects of plant propagation 3. To impart basic knowledge of plant propagating structure 4. To know about role of plant growth regulators on germination and rooting of cutting		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 2 Hrs. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction: General Concepts and Phenomena: Introduction, understanding cellular basis for propagation, sexual and asexual propagation, apomixes, polyembryony, chimeras. Factors influencing seed germination of fruit crops, dormancy, hormonal regulation of seed germination and seedling growth. Seed quality, treatment, packing, storage, certification and testing	8
II	Conventional Asexual Propagation: Cutting– methods, rooting of soft and hardwood cuttings under mist and hotbeds. Use of PGR in propagation, Physiological, anatomical and biochemical aspects of root induction in cuttings. Layering – principle and methods. Budding and grafting – principles and methods, establishment and management of bud wood bank. Stock, scion and inter stock relationship graft incompatibility, physiology of rootstock and top working	8
III	Micro propagation: Micro-propagation–principles and concepts, commercial exploitation in horticultural crops. Techniques – in-vitro clonal propagation, direct organogenesis, embryogenesis, micro grafting, meristem culture, genetic fidelity testing. Hardening, packaging and	8

	transport of micro-propagules.	
IV	Management Practices and Regulation: Nursery – types, structures, components, planning and layout. Nursery management practices for healthy propagule production. Nursery Act, nursery accreditation, import and export of seeds and planting material and quarantine.	8

Reference / Text Books:

- Bose TK, Mitra SK and Sadhu MK. 1991. Propagation of Tropical and Subtropical Horticultural Crops. NayaProkash, Kolkatta.
- Davies FT, Geneve RL and Wilson SB. 2018. Hartmann and Kester's Plant Propagation- Principles and Practices. Pearson, USA/ Prentice Hall of India. New Delhi.
- Gill SS, BAL JS and Sandhu AS. 2016. Raising Fruit Nursery. Kalyani Publishers, New Delhi.
- Jain S and Ishil K. 2003. Micropropagation of Woody Trees and Fruits. Springer.
- Jain S and Hoggmann H. 2007. Protocols for Micropropagation of Woody Trees and Fruits. Springer.
- Joshi P. 2015. Nursery Management of Fruit Crops in India. NIPA, New Delhi.
- Sharma RR. 2014. Propagation of Horticultural Crops. Kalyani Publishers, New Delhi.
- Sharma RR and Srivastav M. 2004. Propagation and Nursery Management. Intl. Book Publishing Co., Lucknow.

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Prerequisites for the course:

Course Learning Outcomes:

- CO1: Study about the different methods of cutting, budding, layering and grafting.
CO2: Learn about the process of graft union.
CO3: Students are able to know about role of green house in propagation of plants.
CO4: Students are able to know about role of plastic in propagating structure.
CO5: Study about different rootstock used for budding and grafting.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: M.Sc. (Hort.) Fruit Science		Year : I Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Horticulture
Course Code: FSC 504		Title: Breeding of Fruit Crops
Course Objectives: 1. To give students a thorough understanding of the concepts, methods, and procedures related to the improvement and breeding of fruit-bearing plants. 2. Different breeding strategies, including traditional ones (mass selection, pedigree selection, etc.) and contemporary ones (molecular breeding, biotechnology), will be explained to the students. They will discover how to successfully use these techniques to accomplish particular breeding objectives. 3. The goal of this course is normally to give students the theoretical knowledge and practical skills needed to create new and improved fruit varieties with desirable characteristics.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 1 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction-Importance, Taxonomy and Genetic Resources: Introduction and Importance, origin and distribution, taxonomical status – species and cultivars, cytogenetics, genetic resources of Mango, Banana, Pineapple, Citrus, Grapes, Litchi, Guava, Pomegranate.	8
II	Introduction-Importance, Taxonomy and Genetic Resources: Introduction and Importance, origin and distribution, taxonomical status – species and cultivars, cytogenetics, genetic resources of Papaya, Apple, Pear, Plum, Peach, Apricot, Cherries, Strawberry, Kiwifruit, Nuts	8
III	Blossom Biology and Breeding Systems: Blossom biology, breeding systems–spontaneous mutations, polyploidy, incompatibility, sterility, parthenocarpy, apomiXis, breeding objectives, ideotypes.	8
IV	Conventional and Non-Conventional Breeding: Approaches for crop improvement–direct introduction, selection, hybridization, mutation breeding, polyploid breeding, rootstock breeding, improvement of quality traits, resistance breeding for biotic and abiotic stresses, biotechnological	8

interventions, achievements and future thrusts.	
Reference / Text Books: - Abraham Z. 2017. <i>Fruit Breeding</i>. Agri-Horti Press, New Delhi. - Badenes ML and Byrne DH. 2012. <i>Fruit Breeding</i>. Springer Science, New York. - Dinesh MR. 2015. <i>Fruit Breeding</i>, New India Publishing Agency, New Delhi. - Ghosh SN, Verma MK and Thakur A. 2018. <i>Temperate Fruit Crop Breeding-Domestication to Cultivar Development</i>. NIPA, New Delhi. - Hancock JF. 2008. <i>Temperate Fruit Crop Breeding: Germplasm to Genomics</i>. Springer Science, New York. - Jain SN and Priyadarshan PM. 2009. <i>Breeding Plantation and Tree Crops: Tropical Species</i>. Springer Science, New York. - Jain S and Priyadarshan PM. 2009. <i>Breeding Plantation and Tree Crops: Temperate Species</i>. Springer Science, New York. - Janick J and Moore JN. 1996. <i>Fruit Breeding</i>. Vols. I–III. John Wiley & Sons, USA. - Kumar N. 2014. <i>Breeding of Horticultural Crops: Principles and Practices</i>. NIPA, N. Delhi. - Moore JN and Janick J. 1983. <i>Methods in Fruit Breeding</i>. Purdue University Press, USA. - Ray PK. 2002. <i>Breeding Tropical and Subtropical Fruits</i>. Narosa Publ. House, New Delhi.	
If the course is available as Generic Elective then the students of following departments may opt it. NA	
Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: - Recognize the significance and unique characteristics of fruit breeding - Be up to date on genetics, reproduction biology, and natural breeding methods. - Be well-versed in the various methodologies and breeding techniques for fruit crops.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M.Sc. (Hort.) Fruit Science		Semester: II
Credits: 3		Subject: Horticulture
Theory: 2		
Practical: 1		
Course Code: FSC 509		Title: Biotechnology of Fruit Crops
Course Objectives: 1. Understanding the principles, theoretical aspects and developing skills in biotechnology of horticultural crops		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 2 Hrs. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction, History and Basic Principles: Introduction and significance, history and basic principles, influence of explant material, physical, chemical factors and growth regulators on growth and development of plant cell, tissue and organ culture.	6
II	In-vitro Culture and Hardening: Callus culture – types, cell division, differentiation, morphogenesis, organogenesis, embryogenesis; Organ culture – meristem, embryo, anther, ovule culture, embryo rescue, somaclonal variation, protoplast culture.	6
III	Use of bioreactors and in-vitro methods for production of secondary metabolites, suspension culture, nutrition of tissues and cells, regeneration of tissues. Hardening and ex vitro establishment of tissue cultured plants.	6
IV	In-vitro Breeding, Transgenics and Gene Technologies: Somatic cell hybridisation, construction and identification of somatic hybrids and cybrids, wide hybridization, in-vitro pollination and fertilization, haploids, in-vitro mutation, artificial seeds, cryopreservation, In-vitro selection for biotic and abiotic stress.	6
V	Genetic engineering-principles and methods, transgenics in fruit crops, use of molecular markers and genomics. Gene silencing, gene tagging, gene editing, achievements of biotechnology in fruit crops	6
Reference / Text Books: 1. Brown TA. 2001. Gene Cloning and DNA Analysis and Introduction. Blackwell Publishing, USA.		

2. Chahal GS and Gosal SS. 2010. Principles and Procedures of Plant Breeding: Biotechnological and Conventional Approaches. Narosa, New Delhi.
3. Chopra VL and Nasim A. 1990. Genetic Engineering and Biotechnology – Concepts, Methods and Applications. Oxford& IBH, New Delhi.
4. Kale C. 2013. Genome Mapping and Molecular Breeding in Plant, Vol 4. Fruit and Nuts. Springer.
5. Keshava Chandran R and Peter KV. 2008. Plant Biotechnology: Tissue Culture and Gene Transfer. Orient & Longman, Universal Press, US.
6. Peter KV. 2013. Biotechnology in Horticulture: Methods and Applications. NIPA, New Delhi.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: After the successful completion of the course, the students are expected to know CO1: Basic principles and methods of plant tissue culture and other biotechnological tools. CO2: The use and progress of biotechnology in fruit crops. CO3: Learn the basic methods of fruit crop improvement and limitations of fruit crop breeding. CO4: Hands on training on tissue culture methods, various standardizing media for embryo and ovule culture were provided CO5: Students were exposed to various Micro-propagation – principles and concepts, commercial exploitation in horticultural crops.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M.Sc. (Hort.) Fruit Science		Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Horticulture
Course Code: FSC 511		Title: Export Oriented Fruit Production
Course Objectives: 1. To equip students with the specific knowledge and abilities needed for fruit production that is effective and targeted at global markets. 2. To comprehend the worldwide market, to choose cultivars that meet quality criteria, and to organize the production of fruit crops		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 2 Hrs. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Statistics and World Trade: National and international fruit export and import scenario and trends; Statistics and India's position and potentiality in world trade; eXport promotion zones in India. Government Policies	8
II	Policies, Norms and Standards: Scope, produce specifications, quality and safety standards for export of fruits, Viz., mango, banana, grape, litchi, pomegranate, walnut, apple and other important fruits. Processed and value-added products, post-harvest management for export including packaging and cool chain; HACCP, Codex alimentarius, ISO certification; WTO and its implications, sanitary and phyto-sanitary measures.	8
III	Infrastructure and Plant Material: Quality fruit production under protected environment; different types of structures–Automated greenhouses, glasshouse, shade net, poly tunnels – Design and development of low cost greenhouse structures	8
IV	Seed and planting material; meeting eXport standards, implications of plant variety protection – patent regimes	8
Reference / Text Books: • Chadha KL. 1995. Advances in Horticulture. Vol. XII. Malhotra Publ. House, New Delhi. • Dattatreylul M. 1997. Export potential of Fruits, Vegetables and Flowers from India. NABARD, Mumbai.		

- Islam, C.N. 1990. Horticultural Export of Developing Countries: Past Preferences, Future Prospects and Policies. International Institute of Food Policy Research, USA

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: Consequent upon successful completion of the course, the students are expected to have learnt about CO1: National and international trade scenario of fruit crops CO2: Set norms and standards for export of fruit crops CO3: Requisite infrastructure and growing practices meeting export standards.	

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M.Sc. (Hort.) Fruit Science		Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Horticulture
Course Code: VSC 504		Title: Principles of Vegetable Breeding
Course Objectives: 1. To give students a thorough understanding of both the academic and practical sides of breeding vegetable crops for better characteristics, productivity, and sustainability.		
Nature of Paper: Core Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks /Theory 2, Practical 1 = 3 Credits		
L: 3 T: 0 P: 0 (In Hours/Week) Theory - 3 Hr. = 3 Credit Practical- 0 Hrs.=0Credit (3Hrs./Week = 3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Importance and history- Importance, history and evolutionary aspects of vegetable breeding and its variation from cereal crop breeding.	6
II	Selection procedures- Techniques of selfing and crossing; Breeding systems and methods; Selection procedures and hybridization; Genetic architecture; Breeding for biotic stress (diseases, insect pests and nematode), abiotic stress (temperature, moisture and salt) resistance and quality improvement; Breeding for water use efficiency (WUE) and nutrients use efficiency (NUE).	6
III	Heterosis breeding- Types, mechanisms and basis of heterosis, facilitating mechanisms like male sterility, self-incompatibility and seX forms	6
IV	Mutation and Polyploidy breeding; Improvement of asexually propagated vegetable crops and vegetables suitable for protected environment.	6
V	Ideotype breeding- Ideotype breeding; varietal release procedure; DUS testing in vegetable crops; Application of In-vitro and molecular techniques in vegetable improvement. Study of phanerogamic plant parasites. Epidemiology: Factors affecting disease development	6
Reference / Text Books: - Allard RW. 1960. Principle of plant breeding. John Willey and Sons, USA. Kalloo G. 1988. Vegetable breeding (Vol. I, II, III). CRC Press, Fl, USA. - Kole CR. 2007. Genome mapping and molecular breeding in plants-vegetables. Springer, USA. Peter K V and Pradeep - Singh Ram J. 2007. Genetic resources, chromosome engineering, and crop improvement-vegetable		

crops (Vol. 3). CRC Press, Fl, USA.

- Kumar T. 1998. Genetics and breeding of vegetables. ICAR, New Delhi, p.488.
- Prohens J and Nuez F. 2007. Handbook of plant breeding-vegetables (Vol I and II). Springer, USA.
- Singh BD. 2007. Plant breeding- principles and methods (8th edn.). Kalyani Publishers, New Delhi.

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

Evaluation/Assessment Methodology

	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100

Prerequisite for the course

Course Learning Outcomes:

Upon successful completion of this course/paper, students should be able to:

Students are more prepared to participate in vegetable breeding research and practices in the following ways:

1. Students are better able to address the challenges of sustainable agriculture;
2. Students can contribute to the development of improved vegetable varieties;
3. Students are better able to make decisions in the area of vegetable crop improvement.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D. Class: M.Sc. (Ag.) Horticulture		Year: I Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Horticulture
Course Code: VSC 512		Title: Production Technology of Spice Crops
Course Objectives: 1. To give students specialized information and abilities about the methods, ideas, and procedures involved in creating high-quality vegetable crop seeds. 2. To impart basic knowledge about the importance and production technology of spices grown in India.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 1 (In Hours/Week) Theory - 2 Hrs. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction, importance of spice crops-historical accent, present status-national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties / hybrids, site selection, layout, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed planting material and micro-propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of Black pepper and cardamom	7
II	Introduction, importance of spice crops-historical accent, present status-national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, site selection, layout, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed planting material and micro-propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected	7

	cultivation of Clove, cinnamon and allspice	
III	Introduction, importance of spice crops-historical accent, present status -national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties / hybrids, site selection, layout, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed planting material and micro-propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of Turmeric, ginger and garlic	6
IV	Introduction, importance of spice crops-historical accent, present status-national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, site selection, layout, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed planting material and micro-propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of Coriander, fenugreek, cumin, fennel and celery	6
V	Introduction, importance of spice crops-historical accent, present status-national and international, future prospects, botany and taxonomy, climatic and soil requirements, commercial varieties/hybrids, site selection, layout, sowing/planting times and methods, seed rate and seed treatment, nutritional and irrigation requirements, intercropping, mixed cropping, intercultural operations, weed control, mulching, physiological disorders, harvesting, post-harvest management, plant protection measures and seed planting material and micro-propagation, precision farming, organic resource management, organic certification, quality control, pharmaceutical significance and protected cultivation of Tamarind and vanilla	6

Reference / Text Books:

- Agarwal S, Sastry EVD & Sharma RK. 2001. Seed Spices:
- Production, Quality, Export. Pointer Publ.
- Arya PS. 2003. Spice Crops of India. Kalyani.
- Bhattacharjee SK. 2000. Hand Book of Aromatic Plants. Pointer Publ.
- Bose TK, Mitra SK, Farooqi SK & Sadhu MK (Eds.). 1999. Tropical
- Horticulture. Vol.I. Naya Prokash.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- Able to understand about the basic criteria for selection of under exploited vegetable crops on the basis of soil and climate requirement.
- Learn the basic knowledge regarding different cultural practices followed for underutilized vegetable crops
- Able to know about sowing time of specific varieties for different under exploited vegetables according to region and season.
- Study of irrigation and nutrient management and their applications in production of under exploited vegetable crops
- By the end of course students will be able to know different physiological disorders of under exploited vegetables and can control different insect pests and diseases.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: II
Class: M.Sc. (Hort.) Fruit Science		Semester: III
Credits: 3		Subject: Horticulture
Theory: 2		
Practical: 1		
Course Code: FSC 505		Title: Systematic of Fruit Crops
Course Objectives: 1. To give pupils a thorough understanding of how fruit-bearing plants are classified, diverse, taxonomically classified, and related in terms of evolution.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L:2 T: 0 P: 1 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Nomenclature and Classification: Biosystematics–Introduction and significance; history of nomenclature of cultivated plants, classification and nomenclature systems; International code of nomenclature for cultivated plants.	8
II	Identification and Description: Methods of identification and description of cultivated fruit and nut species and their wild relatives features; development of plant keys for systematic identification and classification.	8
III	Development of fruit crop descriptors-based upon Bioversity International Descriptors and UPOV/ DUS test guidelines, botanical and pomological description of major cultivars and rootstocks of tropical, subtropical and temperate fruits and nut crops.	8
IV	Registration and Modern Systematic: Registration, Use of Chemotaxonomy, biochemical and molecular markers in modern systematic.	8
Reference / Text Books: 1. ASHS. 1997. <i>The Brooks and Olmo Register of Fruit and Nut Varieties</i> . 3 rd Ed. ASHS Press. 2. Bhattacharya B and Johri BM. 2004. <i>Flowering Plants: Taxonomy and Phylogeny</i> . Narosa Pub. House, New Delhi. 3. Pandey BP. 1999. <i>Taxonomy of Angiosperms</i> . S. Chand & Co. New Delhi. 4. Pareek OP and Sharma S. 2017. <i>Systematic Pomology</i> . Scientific Publishers, Jodhpur. 5. Sharma G, Sharma OC and Thakur BS. 2009. <i>Systematics of Fruit Crops</i> . NIPA, New Delhi. 6. Simpson M. 2010. <i>Plant Systematics</i> . 2 nd Edn. Elsevier.		

7. Spencer RR, Cross R and Lumley P. 2003. *Plant Names*. 3rd Ed. *A Guide to Botanical Nomenclature*, CISRO, Australia.
8. Zielinski QB. 1955. *Modern Systematic Pomology*. Wm. C. Brown Co., Iowa, USA.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: After successful completion of the course, the students would be able to CO1: Categorise different fruit species into broad groups. CO2: Identify various fruit cultivars on basis of distinguishing features CO3: Characterize fruit cultivars for description, registration and protection	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M.Sc. (Hort.) Fruit Science		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject Horticulture
Course Code: FSC 510		Title: Organic Fruit Culture
Course Objectives: 1. To familiarize procedure and methods of fruit growing & their fundamentals. 2. To study packages and practices of planting orchard.		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L:2 T: 0 P: 1 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Principles and Current Scenario: Organic horticulture, scope, area, production and world trade, definition, principles, methods and SWOT analysis.	8
II	Farming System and Practices: Organic farming systems including biodynamic farming, natural farming, homa organic farming, rishi krishi, EM technology, cosmic farming; on-farm and off-farm production of organic inputs, role of bio-fertilizers, bio enhancers, legumes, inter cropping, cover crops, green manuring, zero tillage, mulching and their role in organic nutrition management.	8
III	Organic seeds and planting materials, soil health management in organic production, weed management practices in organic farming, biological management of pests and diseases, trap crops, quality improvement in organic production of fruit crops	8
IV	Inspection, Control Measures and Certification: Inspection and certification of organic produce, participatory guarantee system (PGS), NPOP, documentation and control, development of internal control system (ICS), Concept of group certification, constitution of grower group as per NPOP, preparation of ICS manual, internal and external Practicals	8
Reference / Text Books: • Claude A. 2004. The Organic Farming Sourcebook. Other India Press, Mapusa, Goa, India. • Dabholkar SA. 2001. Plenty for All. Mehta Publishing House, Pune, Maharashtra. • Das HC and Yadav AK. 2018. Advances in Organic Production of Fruit Crops. Westville Publishing House, New Delhi.		

- Deshpande MS. 2003. Organic Farming with respect to Cosmic Farming. Mrs. Pushpa Mohan Deshpandey, Kolhapur, Maharashtra.
- Gaur AC, Neblakantan S and Dargan KS. 1984 Organic Manures. ICAR, New Delhi.
- Lampkin, N. and Ipswich, S. 1990. Organic Farming. Farming Press. London, UK.
- Lind K, Lafer G, Schloffer K, Innershofer G and Meister H. 2003. Organic Fruit Growing. CAB International.
- Palaniappan SP and Annadurai K. 2008. Organic Farming-Theory and Practice. Scientific Publishers, Jodhpur, Rajasthan, India.
- Palekar S. 2004. The Technique of Spritual Farming. Chandra Smaritee, Sai Nagar, Amrawati, Maharashtra.
- Proctor P. 2008. Biodynamic Farming and Gardening. Other India Press, Mapusa, Goa.
- Ram RA and Pathak RK. 2017. Bioenhancers. Lap Lambert Academic Publishing, AP.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: Upon successful completion of this course/paper, students should be able to: CO1: Familiarize with the concepts and practices of organic and other natural farming systems CO2: Generate know-how on procedures, policies and regulation for inspection and certification of organic produce CO3: Students learn how maintain organic farming maintain soil fertility.	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: M.Sc. (Hort.) Fruit Science		Year: II Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Horticulture
Course Code: VSC 501		Title: Production of Cool Season Vegetable Crops
Course Objectives: 1. To know about Soil and Climate requirement of Cool Season Vegetables 2. Familiar with different varieties and methods of sowing in different vegetables. 3. Knowledge of Seed production technology of cool season vegetable 4. Knowledge of crop protection measure in different crops		
Nature of Paper: Core Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 2 T: 0 P: 1 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hrydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of crops. Viz. Bulb and tuber crops— Onion, garlic and potato.	6
II	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hrydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant	6

	growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of crops. Viz. Cole crops—Cabbage, cauliflower, kohlrabi, broccoli, Brussels sprouts and kale.	
III	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of crops. Viz. Root crops—Carrot, radish, turnip and beetroot	6
IV	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of crops. Viz. Peas and beans—Garden peas and broad bean	6
V	Introduction, commercial and nutritional importance, origin and distribution, botany and taxonomy, area, production, productivity and constraints, soil requirements, climatic factors for yield and quality, commercial varieties/ hybrids, seed rate and seed treatment, raising of nursery, sowing/ planting time and methods, hydroponics and aeroponics, precision farming, cropping system, nutritional including micronutrients and irrigation requirements, intercultural operations, special horticultural practices, weed control, mulching, role of plant growth regulators, physiological disorders, maturity indices, harvesting, yield, post-harvest management (grading, packaging and marketing), pest and disease management and production economics of crops. Viz. Leafy vegetables—Beet leaf, fenugreek, coriander and lettuce.	6
Reference / Text Books:		
• Handbook of Entomology • Insecta: An introduction		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks

1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: CO1: Able to know what are the basic criteria for selection of soil and climate for vegetable crops. CO2: Can use the basic knowledge regarding different cultural practices followed for cool season vegetables. CO3: Students are able to know about sowing time of different varieties according to temperature. CO4: Study of irrigation and nutrient management and their applications in production vegetables. CO5: By the end of course students will be able to control of different insect pests.	



Evaluation Scheme

M. Sc (Ag.) Soil Science

Year: I / Semester: I

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	SOILS-501	Soil Physics	3	2	1	50	20	30	60	100
2	SOILS- 504	Soil Mineralogy, Genesis, Classification and Survey	3	2	1	50	20	30	60	100
3	SOILS -511	Management of Problematic Soils and Water	3	2	1	50	20	30	60	100
4	AGRON-501	Modern Concept In Crop Production	3	3	0	70	0	30	60	100
5	STAT-502	Statistical Methods for Applied Sciences	4	3	1	50	20	30	60	100
6	MCA-511	Introduction to Networking and Internet Applications	2	1	1	50	20	30	60	100
7	PGS-501	Library and Information Services	1	0	1	0	100	0	60	100
8	PGS-503	Intellectual Property and its management in Agriculture	1	1	0	70	0	30	60	100
Total			20	14	6	390	200	210	480	800

Year: I / Semester: II

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	SOILS-502	Soil fertility and fertilizer use	3	2	1	50	20	30	60	100
2	SOILS-506	Soil biology and Biochemistry	3	2	1	50	20	30	60	100
3	SOILS- 503	Soil chemistry	3	2	1	50	20	30	60	100

4	AGRON-502	Principles and practices of soil fertility and nutrients management	3	2	1	50	20	30	60	100
5	AGRON-504	Principles and practices of water management	3	2	1	50	20	30	60	100
6	PGS-502	Technical Writing and Communications Skills	1	0	1	0	100	0	60	100
7	SOILS-591	Master's Seminar	1	0	1	0	100	0	60	100
8	SOILS-599	Master's Research	10	0	0	0	0	0	0	0
Total			27	10	7	250	300	150	420	700

Year: II / Semester: III

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	SOILS-510	Analytical Technique And Instrumental Methods in Soil and Plant Analysis	2	0	2	0	100	0	60	100
2	SOILS-513	Soil Survey and Land use Planning	2	2	0	70	0	30	60	100
3	SOILS-505	Soil Erosion and Control Conservation	3	2	1	50	20	30	60	100
4	SOILS-508	Soil, Water and Air Pollution	3	2	1	50	20	30	60	100
5	PGS-504	(e-Course) Basic Concepts in Laboratory Techniques	1	0	1	0	100	0	60	100
6	PGS-505	(e-Course) Agricultural Research, Research Ethics and Rural Development Programmes	1	1	0	70	0	30	60	100
7	SOILS-599	Master's Research	10	0	0	0	0	0	0	0
Total			22	7	5	240	240	120	360	600



Year: II / Semester: IV

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	SOILS-599	Master's Research	20	-	-	100	-	-	60	100
Total			20							100

Format-3

Format-3

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: M. Sc. (Ag) Soil Science		Year: I Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Soil Science
Course Code: SOILS-501*		Title: Soil Physics
Course Objectives: - To gain the knowledge of soil physical properties - To study about the soil formation factors and processes - To assess the importance of soil water for plant growth - To study in detail about soil components - To study about management of soil physical properties for better crop yield		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Basic principles of physics applied to soils, soil as a three-phase system, Soil texture, textural classes, mechanical analysis, and specific surface. Soil consistence; dispersion and workability of soils; soil compaction and consolidation; soil strength; swelling and shrinkage - basic concepts.	5
II	Alleviation of soil physical constraints for crop production. Soil erosion and edibility, Soil structure - genesis, types, characterization and management soil structure; soil aggregation, aggregate stability; soil tilth, characteristics of good soil tilth; soil crusting -mechanism, factors affecting and evaluation; soil conditioners; puddling, its effect on soil physical properties; clod formation.	5
III	Soil water: content and potential, soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential, soil-moisture characteristic curve; hysteresis, measurement of soil-moisture potential.	5
IV	Water flow in saturated and unsaturated soils, Poiseuille's law, Darcy's law; hydraulic conductivity, permeability and fluidity, hydraulic diffusivity; measurement of hydraulic conductivity in saturated and unsaturated soils.	5
V	Infiltration; internal drainage and redistribution; evaporation; hydrologic cycle, field water balance; soil-plant-atmosphere continuum.	5

VI	Composition of soil air; renewal of soil air - convective flow and diffusion; measurement of soil aeration; aeration requirement for plant growth; soil air management, Modes of energy transfer in soils; energy balance; thermal properties of soil; measurement of soil temperature; soil temperature in relation to plant growth; soil temperature management.	5
Suggested Readings: • Baver LD, Gardner WH and Gardner WR. 1972. Soil Physics. John Wiley & Sons. • Ghildyal BP and Tripathi RP. 2001. Soil Physics. New Age International. • Hanks JR and Ashcroft GL. 1980. Applied Soil Physics. Springer Verlag. • Hillel D. 1972. Optimizing the Soil Physical Environment toward Greater Crop Yields. Academic Press. • Hillel D. 1980. Applications of Soil Physics. Academic Press. • Hillel D. 1980. Fundamentals of Soil Physics. Academic Press. • Hillel D. 1998. Environmental Soil Physics. Academic Press. • Hillel D. 2003. Introduction to Environmental Soil Physics. Academic Press. • Indian Society of Soil Science. 2002. Fundamentals of Soil Science. ISSS, New Delhi. • Kirkham D and Powers WL. 1972. Advanced Soil Physics. Wiley-Inter science. • Kohnke H. 1968. Soil Physics. McGraw Hill. • Lal R and Shukla MK. 2004. Principles of Soil Physics. Marcel Dekker. • Oswal MC. 1994. Soil Physics. Oxford & IBH.		
If the course is available as Generic Elective, then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE Class tasks/ Sessional Examination		
4) ESE		50
Total:		100
Course Learning Outcomes: • Experience on the knowledge of soil physical properties and processes in relation to plant growth. • To study about the soil formation factors and processes. • To assess the importance of soil water for plant growth. • To study in detail about soil components. • To study about management of soil physical properties for better crop yield.		

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: M. Sc. (Ag) Soil Science		Year: I Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Soil Science
Course Code: SOILS-504		Title: Soil Mineralogy, Genesis and Classification
Course Objectives: - To Understand Soil Formation Processes - To Analysing Soil Mineral Composition - To Study about Classifying Soils Systematically - To Understand about Correlating Soil Properties with Land Use		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 02 Hrs.=01 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism.	6
II	Classification, structure, chemical composition and properties of clay minerals; genesis and transformation of crystal line and non-crystal line clay minerals; identification techniques; amorphous soil constituents and other.	6
III	Non-crystalline silicate minerals and their identification; clay minerals in Indian soils, role of clay minerals in plant nutrition, interaction of clay with humus, pesticides and heavy metals	6
IV	Factors of soil formation, soil formation models; soil forming processes; weathering of rocks and mineral transformations; soil profile; weathering sequences of minerals with special reference to Indian soils.	6
V	Concept of soil individual; soil classification systems – historical developments and modern systems of soil classification with special emphasis on soil taxonomy; soil classification, soil mineralogy and soil maps – usefulness.	6

- Anantha Krishnan TN. (Ed.). 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH.
- Gaur AC. 1982. A Manual of Rural Composting, FAO/UNDP Regional Project Document, FAO.
- Joshi M. 2016. New Vistas of Organic Farming. Scientific Publishers
- Lampin N. 1990. Organic Farming. Press Books, Ipswich, UK.
- Palaniappan SP and Anandurai K. 1999. Organic Farming – Theory and Practice. Scientific Publ.
- Rao BV Venkata. 1995. Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ.3, Parisaraprajna Parishtana, and Bangalore.
- Reddy MV. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH.
- Sharma A. 2002. Hand Book of Organic Farming. Agrobios.
- Singh SP. (Ed.). 1994. Technology for Production of Natural Enemies. PDBC, Bangalore.
- Subba Rao NS. 2002. Soil Microbiology. Oxford & IBH.
- Trivedi RN. 1993. A Text Book of Environmental Sciences, Anmol Publ.
- Veeresh GK, Shivashankar K and Suiglachar MA. 1997. Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore.
- WHO. 1990. Public Health Impact of Pesticides Used in Agriculture. WHO.
- Woolmer PL and Swift MJ. 1994. The Biological Management of Tropical Soil Fertility. TSBF & Wiley. **Suggested Readings:**

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar on Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- Students understand about the organic farming its varioustypes, biodynamic farming, vedic farming.
- Students will be aware about soil fertility, nutrient recycling, organic residues, organic manures and composting.
- Students will understand control of weeds, diseases and insect pest management, biological agents and pheromones, bio pesticides.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Soil Science		Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Soil Science
Course Code: SOILS-511		Title: MANAGEMENT OF PROBLEMATIC SOILS AND WATERS
Course Objectives: - Foundational ideas for managing brackish water and problem soils. - The management of problematic soils and the responsible use of brackish water in connection to agricultural production will be emphasised. - Learn the ideas and concepts behind troublesome soils and waterways. - Learn about irrigation water quality and standards, as well as reclamation and management of soil physical and chemical restrictions.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 1 Hrs.=0 Credit (3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Area and distribution of problem soils – acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible.	6
II	Morphological features of saline, sodic and saline-sodic soils; characterization of salt-affected soils - soluble salts, ESP, pH; physical, chemical and microbiological properties.	6
III	Management of salt-affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic and dry land soils.	6
IV	Acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management.	6
V	Quality of irrigation water; management of brackish water for irrigation; salt balance under irrigation; characterization of brackish waters, area and extent; relationship in water use and quality. Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters	6

Suggested Readings:

- Bear FE. 1964. Chemistry of the Soil. Oxford & IBH.
- Jurinak JJ. 1978. Salt-affected Soils. Department of Soil Science & Biometeorology. Utah State Univ.
- USDA Handbook No. 60. 1954. Diagnosis and improvement of Saline and Alkali Soils. Oxford & IBH.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- To learn the fundamentals of the factors that contributes to poor soils.
- To educate people on the classification and characterization of India's salt-affected soils.
- To disseminate information about soil reclamation and control of physical and chemical restrictions
- To survey and map the problematic soils of India To research crop management techniques in irrigation waters and problematic soils

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Soil Science		Semester: II
Credits: 3		Subject: Soil Science
Theory: 2		
Practical: 1		
Course Code: SOILS-502		Title: Soil Fertility and Fertilizer Use
Course Objectives: • To gain the knowledge of nutrient availability • To study about the nutrient mobility • To assess the importance of nutrient use efficiency • To study about soil fertility and productivity • To study about fertilizer and manure use		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 1 Hrs.=1 Credit (3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Definition and concepts of soil health and soil quality; Long-term effects of fertilizers and soil quality, Soil fertility and soil productivity; fertility status of major soils group of India; nutrient sources – fertilizers and manures; Criteria of essentiality, classification, law of minimum and maximum, essential plant nutrients - functions and deficiency symptoms, Nutrient uptake, nutrient interactions in soils and plants; long term effect of manures and fertilizers on soil fertility and crop productivity.	6
II	Soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency.	6
III	Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behaviour in soil sand management under field conditions. Potassium forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions.	6

IV	Sulphur - source, forms, fertilizers and their behaviour in soils; role in crop and human health; calcium and magnesium- factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers.	6
V	Micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability, Common soil test methods for fertilizer recommendations; quantity intensity relationships; soil test crop response correlations and response functions.	6
VI	Fertilizer use efficiency; site-specific nutrient management; plant need based nutrient management; integrated nutrient management; speciality fertilizers concept, need and category. Current status of speciality fertilizers uses in soils and crops of India; Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture, Determination of critical limit, DRIS	6

Suggested Readings:

1. Brady NC and Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.
2. Kabata-Pendias A and Pendias H. 1992. Trace Elements in Soils and Plants. CRC Press.
3. Kannaiyan S, Kumar K and Govindarajan K. 2004. Biofertilizers Technology. Scientific Publ.
4. Leigh J G. 2002. Nitrogen Fixation at the Millennium. Elsevier.
5. Mengel K and Kirkby EA. 1982. Principles of Plant Nutrition. International Potash Institute, Switzerland.
6. Mortvedt JJ, Shuman LM, Cox FR and Welch RM. 1991. Micronutrients in Agriculture. 2nd Ed. SSSA, Madison.
7. Pierzinsky GM, Sims TJ and Vance JF. 2002. Soils and Environmental Quality. 2nd Ed. CRC Press.
8. Stevenson FJ and Cole MA. 1999. Cycles of Soil: Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. John Wiley & Sons.
9. Tisdale SL, Nelson SL, Beaton JD and Havlin JL. 1999. Soil Fertility and Fertilizers. 5th Ed. Prentice Hall of India.
10. Troeh FR and Thompson LM. 2005. Soils and Soil Fertility. Blackwell

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar on Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- To gain the knowledge of nutrient availability.
- To study about the nutrient mobility.
- To assess the importance of nutrient use efficiency.
- To study about soil fertility and productivity.
- To study about fertilizer and manure use.

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Soil Science		Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Soil Science
Course Code: SOILS-503		Title: Soil Chemistry
Course Objectives: - To study earth's elemental composition and basics of physical chemistry. - To learn properties of soil colloids, Knowledge of soil organic matter. - To study ion exchange processes in soil. - To know chemistry of NPK in soil. - To know chemistry of problematic soils.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 3 Hr. = 3 Credit Practical- 0 Hrs.=0 Credit (3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Chemical (elemental) composition of the earth's crust, soils, rocks and minerals, Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics.	6
II	Soil colloids: inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge soil components, surface charge characteristics of soils; diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids; electrometric properties of soil colloids; sorption properties of soil colloids; soil organic matter - fractionation of soil organic matter and different fractions, Characterization of OM; clay-organic interactions.	6
III	Ion exchange processes in soil; cation exchange-theories based on law of mass action (Kerr-Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, Donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement, thermodynamics, statistical mechanics; anion and ligand exchange inner sphere and outer-sphere surface complex formation, fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions, shift of PZC on ligand exchange, AEC, CEC; experimental methods to study ion exchange phenomena and practical implications in plant nutrition.	6

IV	Potassium, phosphate and ammonium fixation in soils covering specific and nonspecific sorption; precipitation-dissolution equilibria; Concept of quantity/intensity (Q/ I) relationship; step and constant-rate K; management aspects, Chemistry of acid soils; active and potential acidity; lime potential, chemistry of acid soils; sub-soil acidity.	6
V	Chemistry of salt-affected soils and amendments; soil pH, ECe, ESP, SAR and important relations; soil management and amendments, Chemistry and electrochemistry of submerged soils, geochemistry of micronutrients, environmental soil chemistry	6

Suggested Readings:

- Bear RE. 1964. Chemistry of the Soil. Oxford and IBH.
- Bolt GH and Bruggenwert MGM. 1978. Soil Chemistry. Elsevier.
- Greenland DJ and Hayes MHB. 1981. Chemistry of Soil Processes. John Wiley & Sons.
- Greenland DJ and Hayes MHB. Chemistry of Soil Constituents. John Wiley & Sons.
- McBride MB. 1994. Environmental Chemistry of Soils. Oxford University Press.
- Sposito G. 1981. The Thermodynamics of Soil Solutions. Oxford University Press.
- Sposito G. 1984. The Surface Chemistry of Soils. Oxford University Press.
- Sposito G. 1989. The Chemistry of Soils. Oxford University Press.
- Stevenson FJ. 1994. Humus Chemistry. 2nd Ed. John Wiley & Sons.
- Van Olphan H. 1977. Introduction to Clay Colloid Chemistry. John Wiley & Sons.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar on Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- Knowledge about earth's elemental composition and physical chemistry.
- Understand the properties of inorganic and organic soil colloids.
- Understand the ion exchange processes in soil.
- Knowledge of sorption-desorption mechanisms and NPK chemistry in soil.
- Understand the chemistry of problematic soils.

IIMTU-NEP IMPLEMENTATION
Year: I / Semester: II

Programme: Certificate / Diploma/ Degree/ UG/PG/PhD Class: M. Sc. (Agriculture) Soil Science		Year: I Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Soil Science
Course Code: SOILS-506		Title: (e-course) Soil Biology and Biochemistry
Course Objectives: - To provide basic conceptual understanding Soil biota, soil microbial ecology and types of soil organisms - To understand biochemistry of root-soil interface. - To know about the soil characteristics influencing growth and activity of microflora. - To know about the microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (3Hrs./Week=2Credits)		
Unit	CONTENT	No. of Lectures Allotted
I	Preparation of solutions for standard curves, indicators and standard solutions for acid-base, oxidation reduction and complexometric titration; soil, water and plant sampling techniques, their processing and handling.	3
II	Determination of nutrient potentials and potential buffering capacities of soils for phosphorus and potassium; estimation of phosphorus, ammonium and potassium fixation capacities of soils.	3
III	Principles of visible, ultra violet and infrared spectrophotometry, atomic absorption, flame-photometry, inductively coupled plasma spectrometry; chromatographic techniques, mass spectrometry and X-ray defractrometry; identification of minerals by X-ray by different methods, CHNS analyzer	3
IV	Electrochemical titration of clays; estimation of exchangeable cations (Na, Ca, Mg, K); estimation of root cation exchange capacity.	3
V	Wet digestion/fusion/extraction of soil with aquaregia with soil for elemental analysis; triacid/di-acid digestion of plant samples; determination of available and total nutrients (N, P, K, S, Ca, Mg, Zn, Cu, Fe, Mn, B, Mo) in soils; determination of total nutrients (N, P, K, S, Ca, Mg, Zn, Cu, Fe, Mn, B, Mo) in plants. Drawing normalized exchange isotherms; measurement of redox potential.	3

Suggested Readings:

- Hesse P. 971. *Textbook of Soil Chemical Analysis*. William Clowes & Sons.
- Jackson ML. 1967. *Soil Chemical Analysis*. Prentice Hall of India.
- Keith A Smith 1991. *Soil Analysis; Modern Instrumental Techniques*. Marcel Dekker.
- Kenneth Helrich 1990. *Official Methods of Analysis*. Association of Official Analytical Chemists.
- Page AL, Miller RH and Keeney DR. 1982. *Methods of Soil Analysis*. Part II. SSSA, Madison.
- Piper CE. *Soil and Plant Analysis*. Hans Publ.
- Singh D, Chhonkar PK and Pandey RN. 1999. *Soil Plant Water Analysis - A Methods Manual*. IARI, New Delhi.
- Tan KH. 2003. *Soil Sampling, Preparation and Analysis*. CRC Press/Taylor & Francis.
- Tandon HLS. 1993. *Methods of Analysis of Soils, Fertilizers and Waters*. FDCO, New Delhi.
- Vogel AL. 1979. *A Textbook of Quantitative Inorganic Analysis*. ELBS Longman.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- Development of confidence for setting soil testing laboratory.
- To understand the estimation of root cation exchange capacity.
- To know about the preparation of solutions for standard curves, indicators and standard solutions for acid-base.
- To understand the determination processes of N, P and K in soil and plant.
- To know about the principles of different equipment's uses in soil and plants analysis.

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/ UG/PG/Ph.D. Class: M. Sc. (Ag) Soil Science		Year: II Semester: III
Credits: 2 Theory: 2 Practical: 0		Subject: Soil Science
Course Code: SOILS- 513		Title: Soil Survey and Land Use Planning
Course Objectives: - To teach the better utilization of land for agricultural purposes, and better management of run-off or surplus/ excessive rain-water in the catchment area for agricultural purposes in a watershed. - Basics knowledge of soil series of and establishing soil series. - Basic concepts of soil mapping units, techniques for generation of soil maps. - Study about the application of remote sensing and GIS in soil survey and mapping of major soil group of India		
Nature of Paper: Core/DSE/SEC/GE/AECC: Core, DSE, SEC, GE, Research Projects and Prerequisite/Remedial courses		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 0 = 2 Credits		
L:02 T:00 P: 00 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 0 Hrs.=0 Credit (1Hr./Week=1 Credits)		
Unit	Contents	No. of Lectures Allotted
I	Soil survey and its types; soil survey techniques- conventional and modern; soil series–characterization and procedure for establishing soil series; benchmark soils and soil correlations; soil survey interpretations; thematic soil maps, cartography, mapping units, techniques for generation of soil maps, application of remote sensing and GIS in soil survey and mapping of major soil group of India	4
II	Landform–soil relationship; major soil groups of India with special reference to respective states; land capability classification and land irrigability classification; land evaluation and land use type (LUT)–concept and application; approaches for managing soils and landscapes in the framework of agro-ecosystem.	4
III	Concept and techniques of land use planning; factors governing present land use; Land evaluation method and soil-site suitability evaluation for different crops; land capability classification and constraints in application.	4
IV	Agro-ecological regions/sub-regions of India and their characteristics in relation to crop production. Status of LUP in India.	4
Reference / Text Books:		

- Boul SW, Hole ED, MacCraken RJ and Southard RJ. 1997. *Soil Genesis and Classification*. 4th Ed. Panima Publ.
- Brewer R. 1976. *Fabric and Mineral Analysis of Soils*. John Wiley & Sons.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. ESE	70
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: • Planning for land use in proper way for higher crop productivity. • Knowledge about types of soil survey and their uses. • Concepts of Protection of land from the different land degradation. • Knowledge about the techniques of conservation of degraded land. • Knowledge about the Agro-ecological regions and sub-regions of India and their characteristics in relation to crop production.	

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Soil Science		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Soil Science
Course Code: SOILS- 505		Soil Erosion and Conservation
Course Objectives: To enable students to understand various types of soil erosion and measures to be taken for controlling soil erosion to conserve soil and water.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L:02 T:00 P: 01 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (3Hrs./Week=2Credits)		
Unit	Contents	No. of Lectures Allotted
I	History, distribution, identification and description of soil erosion problems in India. Forms of soil erosion; effects of soil erosion and factors affecting soil erosion	6
II	Types and mechanisms of water erosion; raindrops and soil erosion; rainfall erosivity estimation as EI30 index and kinetic energy; factors affecting water erosion; empirical and quantitative estimation of water erosion; methods of measurement and prediction of runoff; soil losses in relation to soil properties and precipitation.	6
III	Wind erosion- types, mechanism and factors affecting wind erosion; extent of problem in the country. Principles of erosion control; erosion control measures – agronomical and engineering; erosion control structures - their design and layout.	6
IV	Soil conservation planning; land capability classification; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.	6
V	Watershed management - concept, objectives and approach; water harvesting and recycling; flood control in watershed management; socioeconomic aspects of watershed management; case studies in respect to monitoring and 18 evaluations of watersheds; use of remote sensing in assessment and planning of watersheds, sediment measurement	6
Biswas TD and Narayanasamy G. (Eds.) 1996. Soil Management in Relation to Land Degradation and Environment. Bull. Indian Society of Soil Science No. 17.		

- Doran JW and Jones AJ. 1996. Methods of Assessing Soil Quality. Soil Science Society of America, Spl Publ. No. 49, Madison, USA.
- Gurmāl Singh, Venkataramanan C, Sastry G and Joshi BP. 1990. Manual of Soil and Water Conservation Practices. Oxford & IBH.
- Hudson N. 1995. Soil Conservation. Iowa State University Press.
- Indian Society of Soil Science 2002. Fundamentals of Soil Science. ISSS, New Delhi.
- Oswal MC. 1994. Soil Physics. Oxford & IBH.

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

Evaluation/Assessment Methodology	
	Max. Marks
1. Class tasks/ Sessional Examination	30
2. Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3. ESE	50
Total:	100
Prerequisites for the course:	
Course Learning Outcomes: • Understanding Erosion Processes • Identifying Causes of Erosion • Assessing Erosion Severity • Mastering Conservation Principles • Implementing Conservation Practices • Promoting Sustainable Agriculture	

IIMTU-NEP IMPLEMENTATION
Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: M. Sc. (Ag) Soil Science		Year: II Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Soil Science
Course Code: SOILS-508		Title: Soil, Water and Air Pollution
Course Objectives: - To make the student aware of the problems of soil, water and air pollution associated with use of soils for crop production. - Increase your understanding of agricultural, industrial, urban wastes. - Improve the ability of students to know about air, water and soil pollutants. - Know about the pesticides classification, behaviour in soil and effect on soil microorganisms.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Soil, water and air pollution problems associated with agriculture, nature and extent.	6
II	Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants- their CPC standards and effect on plants, animals and human beings.	6
III	Sewage and industrial effluents–their composition and effect on soil properties/ health, and plant growth and human beings; soil as sink for waste disposal.	6
IV	Pesticides–their classification, behaviour in soil and effect on soil microorganisms. Toxic elements–their sources, behaviour in soils, effect on nutrients availability, effect on plant and human health.	6
V	Pollution of water resources due to leaching of nutrients and pesticides from soil; emission of greenhouse gases–carbon dioxide, methane and nitrous oxide. Risk assessment of polluted soil, Remediation/ amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution.	6

Suggested Readings:

- Lal R, Kimble J, Levine E and Stewart BA. 1995. *Soil Management and Greenhouse Effect* CRC Press.
- Middlebrooks EJ. 1979. *Industrial Pollution Control*. Vol. I. *Agro-Industries*. John Wiley Inter-science.
- Ross SM. *Toxic Metals in Soil Plant Systems*. John Wiley & Sons.
- Vesilund PA and Pierce 1983. *Environmental Pollution and Control*. Ann Arbor Science Publ.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- Management of soil and water pollution
- Increase the knowledge of students about pollution of water resources due to leaching of nutrients and pesticides from soil.
- The students have knowledge about amelioration of contaminated soil and water.
- The students have knowledge about the emission of greenhouse gases–carbon dioxide, methane and nitrous oxide.



Evaluation Scheme

M. Sc (Ag.) Agronomy

Year: I / Semester: I

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	AGRON-501	Modern Concepts in Crop Production	3	3	0	70	0	30	60	100
2	AGRON-506	Agronomy of Major Cereals and Pulses	3	2	1	50	20	30	60	100
3	AGRON-513	Principles and practices of organic farming	3	2	1	50	20	30	60	100
4	SOILS-511	Management of Problematic Soils and Waters	3	2	1	50	20	30	60	100
5	STAT-502	Statistical Methods for Applied Sciences	4	3	1	50	20	30	60	100
6	MCA-511	Introduction to Networking and Internet Applications	2	1	1	50	20	30	60	100
7	PGS-501	Library and Information Services	1	0	1	0	100	0	60	100
8	PGS-503	(e-Course) Intellectual Property and its management in Agriculture	1	1	0	70	0	30	60	100
Total			20	14	6	390	200	210	480	800

Year: I / Semester: II

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	AGRON-502	Principles and practices of soil fertility and Nutrient management	3	2	1	50	20	30	60	100
2	AGRON- 503	Principles and Practices of Weed	3	2	1	50	20	30	60	100

		Management								
3	AGRON- 504	Principles and Practices of Water Management	3	2	1	50	20	30	60	100
4	AGRON-507	Agronomy of Oilseed, Fibre and Sugar Crops	3	2	1	50	20	30	60	100
5	SOILS -502	Soil Fertility and Fertilizer Use	3	2	1	50	20	30	60	100
6	PGS-502	Technical Writing and Communications Skills	1	0	1	0	100	0	60	100
7	AGRON- 550	Master's Seminar	1	0	1	0	0	100	60	100
8	AGRON- 560	Master's research	10	0	0	0	0	0	0	0
Total			27	10	7	250	200	250	420	700

Year: II / Semester: III

S. No.	Sub. Code	Subject	Credit	Theory	Lab	External Theory Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	AGRON- 505	Conservation Agriculture	2	1	1	50	20	30	60	100
2	AGRON -511	Cropping System and Sustainable Agriculture	2	2	0	70	0	30	60	100
3	AGRON-509	Agronomy of fodder and forage crops	3	2	1	50	20	30	60	100
4	AGRON- 512	Dryland Farming and Watershed Management	3	2	1	50	20	30	60	100
5	SOILS-509	Remote Sensing and GIS Technique for Soil and Crop Studies	3	2	1	50	20	30	60	100
6	PGS-504	(e-Course) Basic Concepts in Laboratory Techniques	1	0	1	0	100	0	60	100
7	PGS-505	Agricultural Research, Research Ethics and Rural Development Programmes	1	1	0	70	0	30	60	100

8	AGRON-560	Master's research	10	0	0	0	0	0	0	0
Total			25	10	5	340	180	180	700	700

Year: II / Semester: IV

S.No.	Sub. Code	Subject	Credit	Theory	Lab	External Marks	Practical Marks	Internal Marks	Passing Marks	Total Marks
1	AGRON-560	Master's research	20	-	-	100	-	-	60	100
Total										100

Format-3

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Agronomy		Semester: I
Credits: 3 Theory: 3 Practical: 0		Subject: Agronomy
Course Code: AGRON-501*		Title: MODERN CONCEPTS IN CROP PRODUCTION
Course Objectives: • Disseminate contemporary agricultural production concepts, such as tillage, population optimization for plant development, planting geometry, etc. • Talk about the use of growth regulators in agriculture, plant nutrition, and field crop disease tolerance. • Use the optimal plant type concept in organic farming. • Examine crop modelling and crop growth in agronomic systems.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 50% Marks / 3 Credits		
L: 03 T: 00 P: 00(In Hours/Week) Theory - 3 Hr. = 3 Credit Practical- 0 Hrs.=0 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Crop growth analysis in relation to environment; geo-ecological zones of India. Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit.	6
II	Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.	6
III	Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress, use of growth hormones and regulators for better adaptation in stressed condition.	6
IV	Integrated farming systems, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and integrated nutrient management; precision agriculture.	6
V	Modern crop production concepts: soil less cultivation, Aeroponics, Hydroponic, Robotic and terrace farming. use of GIS, GPS and remote sensing in modern agriculture, precision farming and protected agriculture	6

Suggested Readings:

1. Balasubramanian P and Palaniappan SP. 2001. *Principles and Practices of Agronomy*. Agrobios.
2. Paroda R.S. 2003. *Sustaining our Food Security*. Konark Publ.
3. Reddy SR. 2000. *Principles of Crop Production*. Kalyani Publ.
4. Sankaran S and Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing & Publ.
5. Singh SS. 2006. *Principles and Practices of Agronomy*. Kalyani.
6. Lal R. 1989. *Conservation tillage for sustainable agriculture: Tropics versus Temperate Environments*. *Advances in Agronomy* 42: 85-197

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) ESE	70
Total:	100

Course Learning Outcomes:

- Students will get basic idea about crop growth analysis, principles and modern concepts of crop production.
- Precision agriculture and Precision farming, their concepts and application.
- Basics and application crop production under protective agriculture.
- Students understand the zero and minimum tillage: their basics and application

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Agronomy		Semester: I
Credits: 3		Subject: Agronomy
Theory: 2		
Practical: 1		
Course Code: AGRON-506		Title: AGRONOMY OF MAJOR CEREALS AND PULSES
Course Objectives: • Be familiar with the phonological research, yield, nutritional benefits, physiology, cultivation, harvesting, and seed production of the Kharif and Rabi crops. • Gain knowledge of the cropping plans, cultivation techniques, growth indices, etc. for the Kharif and Rabi seasons. • Develop your ability to recognise problems and manage them when growing the Kharif and Rabi crops in India. • Able to cultivate Kharif and Rabi crops using a systematic approach.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 1 Hrs.=1 Credit (3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of: <i>Rabi</i> cereals.	8
II	Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of: <i>Kharif</i> cereals.	8
III	Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of: <i>Rabi</i> pulses.	8

IV	Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of: <i>Kharif</i> pulses.	8
Suggested Readings: 1. Das NR. 2007. Introduction to Crops of India. Scientific Publ. 2. Hunsigi G and Krishna KR. 1998. Science of Field Crop Production. Oxford & IBH. 3. Jeswani LM and Baldev B. 1997. Advances in Pulse Production Technology. ICAR. 4. Khare D and Bhale MS. 2000. Seed Technology. Scientific Publ. 5. Kumar Ranjeet and Singh NP. 2003. Maize Production in India: Golden Grain in Transition. IARI, New Delhi. 6. Pal M, Deka J and Rai RK. 1996. Fundamentals of Cereal Crop Production. Tata Mc Graw Hill. 7. Prasad Rajendra. 2002. Text Book of Field Crop Production. ICAR. 8. Singh C, Singh P and Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH. 9. Singh SS. 1998. Crop Management. Kalyani.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE		50
Total:		100
Course Learning Outcomes: • Students will get basic idea about crop husbandry of cereals. • Concept of major field crops (including cereals, pulses, oilseeds and fiber crops) • Knowledge of farm yard manures soil requirements for field crops including fertilizers, manures, • Basics of origin, history, distribution, adaptations of different crops according to the environment • In-depth knowledge of sustainable agriculture and cropping and farming systems		

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Agronomy		Semester: I
Credits: 3 Theory: 2 Practical: 1		Subject: Agronomy
Course Code: AGRON-513		Title: PRINCIPLES AND PRACTICES OF ORGANIC FARMING
Course Objectives: • Raise awareness of organic farming and its importance to India's, the world's, and future agriculture • Gain knowledge about soil fertility, nutrient cycling, organic residues, organic manures, composting, soil biota, and organic residue breakdown. • Learn how to use soil microflora, earthworms, vermicompost, green manures, and bio fertilisers for farming without using chemicals. • Being able to choose the best agricultural methods, weed control measures, biological agents, pheromone traps, manures, bio fertilisers, and bio insecticides for organic farming.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 02 Hrs.=01 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; principles of organic agriculture; organics and farming standards; organic farming and sustainable agriculture; selection and conversion of land, soil and water management - land use, conservation tillage; shelter zones, hedges, pasture management, agro-forestry.	6
II	Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures, bio-fertilizers and biogas technology.	6
III	Farming systems, selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity.	6
IV	Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides.	6

V	Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy.	6
Suggested Readings: 1. Anantha krishnan TN. (Ed.). 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH. 2. Gaur AC. 1982. A Manual of Rural Composting, FAO/UNDP Regional Project Document, FAO. 3. Joshi M. 2016. New Vistas of Organic Farming. Scientific Publishers 4. Lampin N. 1990. Organic Farming. Press Books, Ipswich, UK. 5. Palaniappan SP and Anandurai K. 1999. Organic Farming – Theory and Practice. Scientific Publ. 6. Rao BV Venkata. 1995. Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ.3, Parisaraprajna Parishtana, and Bangalore. 7. Reddy MV. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH. 8. Sharma A. 2002. Hand Book of Organic Farming. Agrobios. 9. Singh SP. (Ed.). 1994. Technology for Production of Natural Enemies. PDBC, Bangalore. 10. SubbaRao NS. 2002. Soil Microbiology. Oxford & IBH. 11. Trivedi RN. 1993. A Text Book of Environmental Sciences, Anmol Publ. 12. Veeresh GK, Shivashankar K and Suiglachar MA. 1997. Organic Farming and Sustainable Agriculture. Association for Promotion of Organic Farming, Bangalore. 13. WHO. 1990. Public Health Impact of Pesticides Used in Agriculture. WHO. 14. Woolmer PL and Swift MJ. 1994. The Biological Management of Tropical Soil Fertility. TSBF & Wiley.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE		50
Total:		100
Course Learning Outcomes: • Students understand about the organic farming its various types, biodynamic farming, vedic farming. • Students will be aware about soil fertility, nutrient recycling, organic residues, organic manures and composting. • Students will understand control of weeds, diseases and insect pest management, biological agents and pheromones, bio pesticides.		

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: I

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Agronomy		Semester: I
Credits: 3	Subject: Agronomy	
Theory: 2		
Practical: 1		
Course Code: SOILS-511		Title: MANAGEMENT OF PROBLEMATIC SOILS AND WATERS
Course Objectives: - Foundational ideas for managing brackish water and problem soils. - The management of problematic soils and the responsible use of brackish water in connection to agricultural production will be emphasised. - Learn the ideas and concepts behind troublesome soils and waterways. - Learn about irrigation water quality and standards, as well as reclamation and management of soil physical and chemical restrictions.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 1 Hrs.=0 Credit (3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Area and distribution of problem soils – acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible.	5
II	Morphological features of saline, sodic and saline-sodic soils; characterization of salt-affected soils-soluble salts, ESP, pH; physical, chemical and microbiological properties.	5
III	Management of salt-affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic and dry land soils.	5
IV	Acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management.	5
V	Quality of irrigation water; management of brackish water for irrigation; salt balance under irrigation; characterization of brackish waters, area and extent; relationship in water use and quality.	5

VI	Agronomic practices in relation to problematic soils; cropping pattern for utilizing poor quality ground waters	5
Suggested Readings: 1. Bear FE. 1964. Chemistry of the Soil. Oxford & IBH. 2. Jurinak JJ. 1978. Salt-affected Soils. Department of Soil Science & Biometeorology. Utah State Univ. 3. USDA Handbook No. 60. 1954. Diagnosis and improvement of Saline and Alkali Soils. Oxford & IBH.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE		50
Total:		100
Course Learning Outcomes: • To learn the fundamentals of the factors that contributes to poor soils. • To educate people on the classification and characterization of India's salt-affected soils. • To disseminate information about soil reclamation and control of physical and chemical restrictions • To survey and map the problematic soils of India To research crop management techniques in irrigation waters and problematic soils		

IMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.	Year: I	
Class: M. Sc. (Ag) Agronomy	Semester: II	
Credits: 3	Subject: Agronomy	
Theory: 2		
Practical: 1		
Course Code: AGRON-502	Title: Principles and Practices of Soil Fertility and Nutrient Management	
Course Objectives: • Become familiar with the fundamental concepts of soil fertility, plant nutrition management, and soil resource sustainability. • Be familiar with the holistic approach to plant nutrition. • Gain experience conducting laboratory experiments for physical, chemical, and biological qualities on plants and soil. • Capable of resolving issues with soil nutrient deficiencies		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming - basic concepts and definitions.	6
II	Criteria of essentiality of nutrients; Essential plant nutrients – their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.	6
III	Preparation and use of farmyard manure, compost, green manures, vermicompost, bio-fertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Soil less cultivation.	6
IV	Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency; agronomic, chemical and physiological, fertilizer mixtures and grades; methods of increasing fertilizer use efficiency; nutrient interactions.	6

V	Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic nutrients; economics of fertilizer use; integrated nutrient management; use of vermicompost and residue wastes in crops. • Determination of soil pH and soil EC • Determination of soil organic C • Determination of available N, P, K and S of soil • Determination of total N, P, K and S of soil • Determination of total N, P, K, S in plant • Computation of optimum and economic yield.	6
Suggested Readings: 1. Brady NC and Weil RR. 2002. The Nature and Properties of Soils. 13thEd. Pearson Edu. 2. Fageria NK, Baligar VC and Jones CA. 1991. Growth and Mineral Nutrition of Field Crops. Marcel Dekker. 3. Havlin JL, Beaton JD, Tisdale SL and Nelson WL. 2006. Soil Fertility and Fertilizers. 7th Ed. Prentice Hall. 4. Prasad R and Power JF. 1997. Soil Fertility Management for Sustainable Agriculture. CRC Press.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations/Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE		50
Total:		100
Course Learning Outcomes: CO1: The students have knowledge with basic principle of soil fertility management. CO2: The students with general concepts and classification of manures and fertilizer. CO3: The students have knowledge about methods of fertilizer recommendation to crops.		

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.	Year: I	
Class: M. Sc. (Ag) Agronomy	Semester: II	
Credits: 3 Theory: 2 Practical: 1	Subject: Agronomy	
Course Code: AGRON-503	Title: PRINCIPLES AND PRACTICES OF WEED MANAGEMENT	
Course Objectives: • Become familiar with the biology and ecology of weeds, herbicides, the advantages of managing weeds, and the ways in which herbicides are broken down in soil and plant systems. • Increase your understanding of weed management principles and techniques. • Improve your ability to recognise weeds and manage them effectively. • Capable of preparing herbicide solutions in a variety of formations and applying them correctly in fields.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Weed biology, and ecology and classification, crop-weed competition including allelopathy; principles and methods of weed control and classification management; weed indices, weed shift in different eco-systems	6
II	Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides.	6
III	Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures, sequential application of herbicides, rotation; weed control through use of Nano-herbicides and bio-herbicides, myco-herbicides bio-agents, and allele chemicals; movement of herbicides in soil and plant, Degradation of herbicides in soil and plants; herbicide resistance, residue, persistence and management; development of herbicide resistance in weeds and crops and their management, herbicide combination and rotation.	6

IV	Weed management in major crops and cropping systems; alien, invasive and parasitic weeds and their management; weed shifts in cropping systems; aquatic and perennial weed control; weed control in non-crop area.	6
V	Integrated weed management; recent development in weed management-robotics, use of drones and aeroplanes, organic <i>etc.</i> , cost: benefit analysis of weed management.	6

Suggested Readings:

1. Böger, Peter, Wakabayashi, Ko, Hirai, Kenji (Eds.). 2002. Herbicide Classes in Development. Mode of Action, Targets, Genetic Engineering, Chemistry. Springer.
2. Chauhan B and Mahajan G. 2014. Recent Advances in Weed Management. Springer.
3. Das TK. 2008. Weed Science: Basics and Applications, Jain Brothers (New Delhi).
4. Fennimore, Steven A and Bell, Carl. 2014. Principles of Weed Control, 4th Ed, California Weed Sci. Soc.
5. Gupta OP. 2007. Weed Management: Principles and Practices, 2nd Ed.
6. Jugulan, Mithila (ed). 2017. Biology, Physiology and Molecular Biology of Weeds. CRC Press
7. Monaco TJ, Weller SC and Ashton FM. 2014. Weed Science Principles and Practices, Wiley
8. Powles SB and Shaner DL. 2001. Herbicide Resistance and World Grains, CRC Press.
9. Walia US. 2006. Weed Management, Kalyani.
10. Zimdahl RL. (ed). 2018. Integrated Weed Management for Sustainable Agriculture, B. D. Sci. Pub.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- The students have knowledge with basic principle of soil fertility management.
- The students with general concepts and classification of manures and fertilizer.
- The students have knowledge about methods of fertilizer recommendation to crops.

IMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Agronomy		Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Agronomy
Course Code: AGRON-504		Title: PRINCIPLES AND PRACTICES OF WATER MANAGEMNT
Course Objectives: • Explain the physical characteristics of water, its significance in agriculture, and the resources accessible in India. • Recognize how water moves through soils and plants, how water is absorbed and lost by plants, how plants respond to water stress and how it affects their ability to thrive, etc. • Gain knowledge on how to plan irrigation according to weather conditions, crop types, and cropping systems. • Evaluate the irrigation water's quality and improve your capacity to fix drainage and irrigation issues.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Water and its role in plants; Irrigation: Definition and objectives, water resources and irrigation development in of India and concerned state, major irrigation projects, extent of area and crops irrigated in India and in different states.	5
II	Field water cycle, water movement in soil and plants; transpiration; soil-water- plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition. Water availability and its relationship with nutrient availability and loses.	5
III	Soil, plant and meteorological factors determining water needs of crops, scheduling, depth and methods of irrigation; micro irrigation systems; deficit irrigation; fertigation; management of water in controlled environments and polyhouses. Irrigation efficiency and water use efficiency.	5

NAAC Accredited with A GRADE

IV	Water management of crop and cropping system, Quality of irrigation water and management of saline water for irrigation, water use efficiency, Crop water requirement-estimation of ET and effective rainfall; Water management of the major crops and cropping systems. Automated irrigation system.	5
V	Excess of soil water and plant growth; water management in problem soils, drainage requirement of crops and methods of field drainage, their layout and spacing; rain water management and its utilization for crop production.	5
VI	Quality of irrigation water and management of saline water for irrigation, water management in problem soils, Soil moisture conservation, water harvesting, rain water management and its utilization for crop production. Hydroponics, Water management of crops under climate change scenario.	5

Suggested Readings:

1. Majumdar DK. 2014. Irrigation Water Management: Principles and Practice. PHL Learning private publishers.
2. Mukund Joshi. 2013. A Text Book of Irrigation and Water Management Hardcover, Kalyani publishers.
3. Lenka D. 1999. Irrigation and Drainage. Kalyani.
4. Michael AM. 1978. Irrigation: Theory and Practice. Vikas Publ.
5. Paliwal KV. 1972. Irrigation with Saline Water. IARI Monograph, New Delhi.
6. Panda SC. 2003. Principles and Practices of Water Management. Agrobios.
7. Prihar SS and Sandhu BS. 1987. Irrigation of Food Crops - Principles and Practices. ICAR.
8. Reddy SR. 2000. Principles of Crop Production. Kalyani.
9. Singh Pratap and Maliwal PL. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ.

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- Students will get basic idea about Principle and Practices of water management
- To impart the physical properties of water, its importance in agriculture and available resources in India.
- To understand water movement in plant and soils, Absorption and transpiration of water in plants, water deficit stress in plants and its effect on growth.
- Develop skills to schedule the irrigation, their methods with respect to crops and cropping systems and meteorological factors.
- Analyze the quality of irrigation water and develop ability to resolve irrigation and drainage problems.
- To understand about the Soil moisture conservation, water harvesting, rain water management and its utilization for crop production.

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Agronomy		Semester: II
Credits: 3		Subject: Agronomy
Theory: 2		
Practical: 1		
Course Code: AGRON-507		Title: AGRONOMY OF OILSEED, FIBRE AND SUGAR CROPS
Course Objectives: • Become familiar with the distribution of commercial crops throughout various agro-ecosystems in India and the rest of the world. • Gain knowledge of the production methods, economic significance, geographic origins, soil requirements, and climatic requirements of oilseed, fibre, and sugar crops. • Gain knowledge about the techniques for growing sugar, fibre, and oilseed crops. • Capable of growing crops such as sugar, fibre, and oilseeds using a scientific method.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 1 Hrs.=1 Credit (3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Origin and history, area and production, classification, improved varieties, Physical Sciences: Agronomy adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of: <i>Rabi</i> oilseeds – Rapeseed and mustard, Linseed and Niger	8
II	Origin and history, area and production, classification, improved varieties, Physical Sciences: Agronomy adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of <i>Kharif</i> oil seeds - Groundnut, Sesame, Castor, Sunflower, Soybean and Safflower	8
III	Origin and history, area and production, classification, improved varieties, Physical Sciences: Agronomy adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of fiber crops - Cotton, Jute, Ramie and Mesta.	8

IV	Origin and history, area and production, classification, improved varieties, Physical Sciences: Agronomy adaptability, climate, soil, water and cultural requirements, nutrition, quality component, handling and processing of the produce for maximum production of Sugar crops – Sugar-beet and Sugarcane.	8
Suggested Readings: 1. Das NR. 2007. Introduction to Crops of India. Scientific Publ. 2. Das PC. 1997. Oilseed Crops of India. Kalyani. 3. Lakshmikantam N. 1983. Technology in Sugarcane Growing. 2nd Ed. Oxford & IBH. 4. Prasad Rajendra. 2002. Text Book of Field Crop Production. ICAR. 5. Singh SS. 1998. Crop Management. Kalyani.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE		50
Total:		100
Course Learning Outcomes: • Students will get basic idea about crop production of oilseed fibre and pulses • To understand recent crop management practices on crop productivity and resource use efficiency. • To formulate different cropping system and production technologies for various fibre crops. • To analyze the importance of sugar crops and its cultivation practice. • To create awareness about fibre and sugar crops and its production technologies		

IIMTU-NEP IMPLEMENTATION

Year: I / Semester: II

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: I
Class: M. Sc. (Ag) Agronomy		Semester: II
Credits: 3 Theory: 2 Practical: 1		Subject: Agronomy
Course Code: SOILS-502		Title: SOIL FERTILITY AND FERTILIZERS USE
Course Objectives: • Understanding of the fundamental principles of managing soil fertility. • Definitions and categories for manures and fertilisers. • Information about how to advise crops on fertiliser applications. • Understanding of micronutrients, fertiliser application effectiveness, fertiliser quality, and recommendations • Information about how to advise crops on fertiliser applications.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=4Credits)		
Unit	Contents	No. of Lectures Allotted
I	Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms.	6
II	Soil and fertilizer nitrogen, phosphorus, Potassium – sources, forms, immobilization and mineralization, nitrification, de-nitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer in Low land and upland conditions for high fertilizer use efficiency.	6
III	Sulphur - source, forms, fertilizers and their behaviour in soils; calcium and magnesium–factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers.	6
IV	Micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability. Common soil test methods for fertilizer recommendations; quantity–intensity relationships; soil test crop response correlations and response functions.	6

V	Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site-specific nutrient management; plant need based nutrient management; integrated nutrient management. Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.	6
Suggested Readings: 1. Brady NC & Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu. 2. Kabata-Pendias A & Pendias H. 1992. Trace Elements in Soils and Plants. CRC Press. 3. Kannaiyan S, Kumar K & Govindarajan K. 2004. Biofertilizers Technology. Scientific Public. 4. Leigh JG. 2002. Nitrogen Fixation at the Millennium. Elsevier. 5. Mengel K & Kirkby EA. 1982. Principles of Plant Nutrition. International Potash Institute, Switzerland. 6. Mortvedt JJ, Shuman LM, Cox FR & Welch RM. 1991. Micronutrients in Agriculture. 2nd Ed. SSSA, Madison. 7. Pierzinsky GM, Sims TJ & Vance JF. 2002. Soils and Environmental Quality. 2nd Ed. CRC Press. 8. Stevenson FJ & Cole MA. 1999. Cycles of Soil: Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. John Wiley & Sons. 9. Tisdale SL, Nelson SL, Beaton JD & Havlin JL. 1999. Soil Fertility and Fertilizers. 5th Ed. Prentice Hall of India.		
If the course is available as Generic Elective then the students of following departments may opt it. NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE		50
Total:		100
• Students will acquire knowledge on soil fertility and fertilizer use. • To remember the knowledge of soil fertility and nutrient status of major soils of India. • To understand the various fertilizer sources and their management • To apply the knowledge for maintaining the soil fertility status and reduce the harmful effects of chemical fertilizers. • To Analysis the soil nutrient status and various elements required in plant growth. • To evaluate the soil fertility using biological methods, plant and tissue tests		

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Agronomy		Semester: III
Credits: 3		Subject: Agronomy
Theory: 2		
Practical: 1		
Course Code: AGRON-508		Title: CONSERVATION AGRICULTURE
Course Objectives: • Knowledge and concept of different techniques of crop production. • Basics of crop growth in relation to environment and sustainability. • Knowledge of tillage (zero and minimum tillage). • Basic concepts of crop modelling for maximizing crop yield. • Study of Cropping and farming systems for sustainable agriculture.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Conventional and conservation agriculture systems, sustainability concerns, conservation agriculture: Historical background and present concept, global experiences, present status in India.	8
II	Nutrient management in CA, water management, weed management, energy use, insect-pest and disease management, farm machinery, crop residue management, cover crop management.	8
III	Climate change mitigation and CA, C-sequestration, soil health management, soil microbes and CA. CA in agroforestry systems, rainfed / dryland regions	8
IV	Economic considerations in CA, adoption and constraints, CA: The future of agriculture	8
Suggested Readings: 1. Chhidda Singh, Modern techniques of raising field crops. Oxford and IBH Publishing Co. Ltd. Bangalore. 2. Gopal Chandra De. 1980., Fundamentals of Agronomy. Oxford and IBH Publishing Co. Ltd. Bangalore, Hand book of Agriculture, ICAR Publication. 3. Palaniappan, S.P., Cropping Systems in the tropics – Principles and Practices. Willey Eastern Ltd. New Delhi. Panda, S.C., 2006.Agronomy Agribios Publication, New Delhi.		

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) ESE	70
Total:	100
Course Learning Outcomes: • Knowledge and concept of different techniques of crop production • Basics of crop growth in relation to environment and sustainability • Knowledge of tillage (zero and minimum tillage) • Basic concepts of crop modelling for maximizing crop yield • Study of Cropping and farming systems for sustainable agriculture	

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Agronomy		Semester: III
Credits: 2 Theory: 2 Practical: 0		Subject: Agronomy
Course Code: AGRON-511		Title: Cropping Systems and Sustainable Agriculture
Course Objectives: To acquaint the students about prevailing cropping systems in the country and practices to improve their productivity		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 0 = 2 Credits		
L: 02 T: 00 P: 01(In Hours/Week) Theory - 2 Hr. = 2Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use.	6
II	Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems.	6
III	Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary	6
IV	Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Advanced nutritional tools for big data analysis and interpretation.	6
V	Plant ideotypes for dry lands; plant growth regulators and their role in sustainability. Artificial Intelligence- Concept and application.	6

Suggested Readings:

1. Panda SC. 2017. *Cropping Systems and Sustainable Agriculture*. Agrobios (India)
2. Panda SC. 2018. *Cropping and Farming Systems*. Agrobios.
3. Palaniappan SP and Sivaraman K. 1996. *Cropping Systems in the Tropics; Principles and Management*. New Age.
4. Panda SC. 2003. *Cropping and Farming Systems*. Agrobios.
5. Reddy SR. 2000. *Principles of Crop Production*. Kalyani.
6. Sankaran S and Mudaliar TVS. 1997. *Principles of Agronomy*. The Bangalore Printing & Publ. Co.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) ESE	70
Total:	100

Course Learning Outcomes:

- Knowledge and concept of different techniques of crop production
- Basics of crop growth in relation to environment and sustainability
- Basic knowledge on cropping system for sustainable agriculture.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Agronomy		Semester: III
Credits: 3	Subject: Agronomy	
Theory: 2		
Practical: 1		
Course Code: AGRON-509		Title: AGRONOMY OF FODDER AND FORAGE CROPS
Course Objectives: • Become familiar with the important fodder and forage crops' adaptation, distribution, varietal improvement, agro techniques, quality characteristics, and anti-quality factors. • Increase your understanding of the ideas and processes involved in producing fodder and forage crops. • Improve your ability to recognize forage and fodder crops. • Capable of implementing novel techniques for enhancing the nutritional value of fodder and forage crops.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like sorghum, maize, <i>bajra</i> , <i>guar</i> , cowpea, oats, barley, berseem, <i>senji</i> , lucerne, <i>etc.</i>	6
II	Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses lime, Napier grass, <i>Panicum</i> , <i>Lasiurus</i> , <i>Cenchrus</i> , <i>etc.</i>	6
III	Year-round fodder production and management, preservation and utilization of forage and pasture crops.	6
IV	Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder. Fodder production through hydroponics. Azolla cultivation.	6
V	Economics of forage cultivation uses and seed production techniques of important fodder crops.	6

Suggested Readings:

1. Chatterjee BN. 1989. Forage Crop Production - Principles and Practices. Oxford & IBH.
2. Das NR. 2007. Introduction to Crops of India. Scientific Publ.
3. Narayanan TR and Dabadghao PM. 1972. Forage Crops of India. ICAR.
4. Singh P and Srivastava AK. 1990. Forage Production Technology. IGRI, Jhansi.
5. Singh C, Singh P and Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.
6. Tejwani KG. 1994. Agroforestry in India. Oxford & IBH.

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

Evaluation/Assessment Methodology	
	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- This program will provide students the theoretical and research back grounds necessary to design, implement, and manage-different cropping system.
- Students will able to conduct field trials.
- Students able to collect, summarize and interpret data.

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D. Class: M. Sc. (Ag) Agronomy		Year: II
Credits: 3 Theory: 2 Practical: 1		Semester: III
Course Code: AGRON-512N		Subject: Agronomy
Course Objectives: • Spread knowledge of the fundamental principles and traits of dry-land and rain-fed farming. • Gain knowledge of the importance and dimensions of dry land farming in the context of India. • Improve your ability to manage watershed resources and drought conditions. • Capable of analyzing the physiology of crop stress and choosing the appropriate tillage, irrigation, planting, fertilizers, and other practices		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 3 Hr. = 3 Credit Practical- 0 Hrs.=0 Credit (3Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.	6
II	Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.	6
III	Stress physiology and resistance to drought, adaptation of crop plants to drought, Physical Sciences: Agronomy drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions.	6
IV	Tillage, tilth, frequency and depth of cultivation, compaction in soil tillage; concept of conservation tillage; tillage in relation to weed control and moisture conservation; techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use.	6

V	Concept of watershed resource management, problems, approach and components.	6
Suggested Readings: 1. Reddy TY. 2018. Dryland Agriculture Principles and Practices, Kalyani publishers 2. Das NR. 2007. Tillage and Crop Production. Scientific Publ. 3. Dhopte AM. 2002. Agrotechnology for Dryland Farming. Scientific Publ. 4. Dhruv Narayan VV. 2002. Soil and Water Conservation Research in India. ICAR. 5. Gupta US. (Ed.). 1995. Production and Improvements of Crops for Drylands. Oxford & IBH. 6. Katyal JC and Farrington J. 1995. Research for Rainfed Farming. CRIDA. 7. Rao SC and Ryan J. 2007. Challenges and Strategies of Dryland Agriculture. Scientific Publ. 8. Singh P and Maliwal PL. 2005. Technologies for Food Security and Sustainable Agriculture. 9. Singh RP. 1988. Improved Agronomic Practices for Dryland Crops. CRIDA. 10. Singh RP. 2005. Sustainable Development of Dryland Agriculture in India. Scientific Publ. 11. Singh SD. 1998. Arid Land Irrigation and Ecological Management. Scientific Publ. 12. Venkateshwarlu J. 2004. Rainfed Agriculture in India. Research and Development Scenario. ICAR.		
If the course is available as Generic Elective then the students of following departments may opt it.NA		
Evaluation/Assessment Methodology		
		Max. Marks
1) Class tasks/ Sessional Examination		30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report		20
3) ESE		50
Total:		100
Course Learning Outcomes: • Understand about rainfed agriculture and watershed management in India. • Recognize soil, water and climatic conditions dominant in rainfed areas. • Understand about soil and water conservation techniques, watershed management in rainfed areas. • Comprehend integrated watershed management and its factors.		

IIMTU-NEP IMPLEMENTATION

Year: II / Semester: III

Programme: Certificate/Diploma/ Degree/UG/PG/Ph.D.		Year: II
Class: M. Sc. (Ag) Agronomy		Semester: III
Credits: 3 Theory: 2 Practical: 1		Subject: Agronomy
Course Code: SOILS-509		Title: Remote sensing and GIS technique for soil and crop studies
Course Objectives: • Understanding and application of remote sensing • The fundamentals of processing and interpreting images from aerial pictures • Understanding of drought and watershed management • Foundational ideas about the significance of and sources for the temporal and geographical variability in soils • Researching GIS and its use for properties of soil and land that are both spatial and not.		
Nature of Paper: Core		
Minimum Passing Marks/Credits: 60% Marks / Theory 2, Practical 1 = 3 Credits		
L: 02 T: 00 P: 01 (In Hours/Week) Theory - 2 Hr. = 2 Credit Practical- 2 Hrs.=1 Credit (4Hrs./Week=3Credits)		
Unit	Contents	No. of Lectures Allotted
I	Introduction and history of remote sensing; sources, propagation of radiations in atmosphere; interactions with matter.	6
II	Sensor systems - camera, microwave radiometers and scanners; fundamentals of aerial photographs and image processing and interpretations.	6
III	Application of remote sensing techniques - land use soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management, wasteland identification and management.	6
IV	Significance and sources of the spatial and temporal variability in soils; variability in relation to size of sampling; classical and geo-statistical techniques of evolution of soil variability.	6
V	Introduction to GIS and its application for spatial and non-spatial soil and land attributes.	6

Suggested Readings:

1. Brady NC & Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.
2. Elangovan K. 2006. GIS Fundamentals, Applications and Implementations. New India Publ. Agency.
3. Lillesand TM & Kiefer RW. 1994. Remote Sensing and Image Interpretation. 3rd Ed. Wiley.
4. Nielsen DR & Wendroth O. 2003. Spatial and Temporal Statistics. Catena Verlag GmbH.
5. Star J & Esles J. 1990. Geographic Information System: An Introduction. Prentice Hall.

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

Evaluation/Assessment Methodology

	Max. Marks
1) Class tasks/ Sessional Examination	30
2) Presentations /Seminar/Assignments/internal Practical/Research Project Report/Seminar On Research Project Report	20
3) ESE	50
Total:	100

Course Learning Outcomes:

- Fully equipped with concepts, methodologies and applications of Remote Sensing Technology used in agriculture.
- Prepare the candidates for National and Global Employability in the field of agriculture.
- Acquire skills in handling instruments, tools, techniques and modeling while using Remote Sensing Technology.
- It empowers the candidate with confidence and leadership qualities.