PONNAIYAH RAMAJAYAM INSTITUTE OF SCIENCE & TECHNOLOGY (PRIST)

Declared as DEEMED-TO-BE-UNIVERSITY
U/s 3 of UGC Act, 1956

BACHELOR OF SCIENCE (HONS) IN AGRICULTURE

Academic Regulations and Syllabus

Under Choice Based Credit System (CBCS) withOutcome based Education

2023-24 Onwards

1.1. **Academic year:** An academic year is a period during which a cycle of study iscompleted. There shall be two semesters in an academic year. The Academic Calendar will be developed by the University from time to time and notified accordingly by the Registrar in advance.

1.2. **Semester:** A semester shall consist of 95 instructional days with additional 15 days for examination. Thus, a semester will consist of 110 working days.

1.3. **Curriculum:** It is a series of courses offered to provide learning opportunities to meet the requirements for a degree.

1.4. **Course:** A course is a unit of instructions, series of classes and work experience extending over a semester. It has a specific prefix, code number, title and credits. Each course is denoted by specific code number, which has specific meaning. The first three alphabets stand for the department offering the course. First digit is related to the year; Second and third digit is related to number of courses offered by a department in a particular year i.e "AGR 101 Fundamentals of Agronomy" "AGR" stands for the Department of Agronomy. The first digit (1) stands for the year and the third digit (1) stands for the first subject offered by the department in the particular year. The middle digit Zero refers to credit course and 1 refers to non-gradial course.

1.5. **Credit:** It is a measure of quantity of work done in a course. One credit represents one contact hour for theory or two contact hours of laboratory or field work per week. For example, a 1+1 course (2 credits) means 1 hour theory and 2 hours practical per week.

1.6. **Credit load:** It is the number of credits a student undergoes in a semester.

1.7. **Grade Point:** "Grade Point" means the total marks in percentage divided by 10 and shall be expressed on 10 point scale upto second decimal place.

1.8. **Credit point:** A credit point is a product of grade point obtained by a student and number of credits in a course.

1.9. **Grade Point Average (GPA):** It is a measure of the performance of a student in all the courses taken during a semester. The GPA is computed by dividing the total credit points earned by a student in a semester by the total number of credits taken duringthat semester.

1.10. **Overall Grade Point Average (OGPA):** It is a measure of the cumulative performance of a student on completion of the second and subsequent semesters of the degree programme. It is computed by dividing the total credit points earned by a student up to the end of a particular semester by the total number of credits. It shall be expressed on 10 point scale up to the second decimal place.

1.11. The OGPA shall be rounded off to the second digit of the decimal point on the basis of third digit. If the third digit of the decimal point is 5 or more than 5, then second digit will be increased by one. If, however, it is less than 5, it will be ignored. This will be done at the end of each semester while calculating the OGPA.

1.12. **Calculation of OGPA:** To arrive at the "Overall Grade Point Average (OGPA)" at the end of a semester, the grade point of each course is multiplied by the credit hours of thecourse to obtain the credit points. Then, the sum of the credit points secured by the student in all the courses taken till the end of that semester is divided by the total number of credit hours of the courses, provided that the credit hours and credit points ofcourses which are repeated are not counted more than once for this purpose.

For Example

i.	Total credit hours till the end of last semester	18
ii	Total credit points till the end of last semester	140.50
iii	Total credit hours in the current semester	22
iv	Total credit points obtained in the current semester	156
v	Total credit hours including the current semester	(18+22)=40

vi	Total credit points including the current semester	140.50 + 156 = 296.50
vii	Overall Grade Point Average	(296.50/40) = 7.412
viii	Corrected to two decimals	7.41 / 10.00

1.13. "Transcript Card" is a consolidated report of grades secured by the student in all the semesters, issued by the University.

2. Advisory system

2.1. Dean shall nominate a co-ordinator from amongst the teaching faculty.

2.2. Student ward counsellors will be nominated soon after the students' admission. The counsellor shall be nominated from amongst the teaching faculty.

2.3. A student should register the courses for each semester in consultation with the sectional coordinator and **submit the registration card within five working days** from the date of reopening of that semester.

3. Award of Degree, duration and credit requirements

A student is required to complete the duration and credit requirements for the award ofdegree as decided by Academic Council from time to time.

Degree	Duration requirements (Semester)		Credit requirements
	Min	Max	
B.Sc. (Hons) Agriculture	8	16	184

4. Medium of Instruction

The medium of Instruction in the school of Agriculture shall be English.

5. Examinations

Each course shall carry a maximum of 100 marks for the purpose of grading.The distribution of marks shall be as follows.

Course with both theory and practical	**Marks**
Mid Semester Examination	20
Practical Examination (Written = 25, Record = 5 Specimen collection/Assignment/Viva–Voce = 10)	40
Theory Examination	40
Total	**100**
Course with only Theory / Practical	**Marks**
Mid Semester Examination	40
Final Semester Examination	60
Total	**100**

Evaluation pattern for courses with only practical: The evaluation pattern of courses with only practical is grouped and mark distribution is furnished below.

a. PEY 111 Physical Education and Yoga Practice (0+1)

Each student enrolled in PEY 111 should attend two semesters (I and II). The student has to undergo 60 hours of face to face course work in a year out of which 30 hours forphysical education and 30 hours for yoga practice. The students will be evaluated for 100 marks at the end of the second semester. The course teachers will evaluate the performance of students in the classes and marks will be awarded at the end of the second semester as detailed below. The final practical examination will be conductedin the last practical class of the second semester and the course teacher shall send themarks awarded to the Controller of Examinations through the Dean, school of Agriculture.

Particulars	Physical Education	Yoga practice	Total Marks
	Max. marks	Max. marks	
Attendance and routine activities	20	20	40
Participation in special practices	10	10	20
Practical Examination	20	20	40
Total	**50**	**50**	**100**

b. **NSS 111 / NCC 111 (0+1)**

The duration of NCC/NSS training is for four semesters (I, II, III and IV). A student should register either NCC or NSS course in the first semester and evaluated at the end of fourth semester.

c. NSS: A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than five regular one day camp in a year andone special camp for duration of 7 days at any semester break period in the two years.Different activities will include orientation lectures and practical works. At the end of fourth semester, the course teacher shall send the marks awarded to the Controller of Examinations through the Dean, school of Agriculture. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

Marks will be awarded as follows.

S. No.	Particulars	Marks
1	NSS Regular Programme (15 +15 +15 +15) (15 marks/semester)	60
2	NSS Special camp not exceeding 7 days duration (Attendance-30 and Activity -10)	40
	Total	**100**

NCC: A student enrolled in NCC should attend 10 parades per semester, thus 40 parades in four semesters. Marks will be awarded at the rate of two and half marks per parade (2.5 x 40 = 100).

c. AGR 204 Practical Crop Production -I & AGR 301 Practical Crop Production -II

S. No.	Particulars	Mid-semester examination	Final examination
1	Field evaluation	20	20
2	Written examination	20	25
3	Record	-	5
3	Assignment	-	5
4	*Viva-Voce*	-	5
	Total	**40**	**60**

d. AGR 211 Educational Tour-I (Agronomy) & EXT 411 Educational Tour-II (Agricultural Extension)

Educational tour courses AGR 211 Educational Tour-I and EXT 411 Educational Tour- II **(**All India Tour) are compulsory. The tours will be under taken during second andfinal year, respectively. The duration of AGR 211 shall not exceed 7 days and that of EXT 411 shall not exceed 14 days. The tours will be arranged by the respective departments of the study in consultation with the Dean, school of Agriculture. The finalexamination will be conducted at the end of the semester by the University.

Particulars	Max marks	Evaluation by
Attendance	20	Accompanying staff
Behaviour	30	

Final examination		
Tour Diary	20	Examiners
Tour record/ Report	20	
Viva Voce	10	
Total	100	

e. Student READY programme (Rural and Entrepreneurship Awareness Development Yojana) to assure employability and to develop entrepreneurs

This will be undertaken by the students during the seventh and eighth semesters. Student READY shall be run for full year by making two groups and rotating activitiesof the final year in two groups. **To get the eligibility for registering for the Student READY programme, the students should have completed all the courses successfully up to sixth semester. No student should be allowed to take up the Student READY programme with backlog/repeat courses**.

The students shall register for the three components listed below. The minimum attendance required for this programme is 85% in each component. Any student in the event of recording shortage of attendance has to re-register when that component is offered next by paying the necessary fee.

1. Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
2. Rural Agriculture Work Experience (RAWE) 10 credits (10 weeks)
3. In Plant Training/Industrial attachment - 10 credits (10 weeks)

Experiential Learning (EL) aims towards practical work experience in real life situation among the students and therefore it helps the student become "job provider rather job seeker". EL provides students an excellent opputunity to develop entrepreneurial skillsthrough meaningful hands-on experience and confidence. As the programme is enterprise oriented, students and faculty are to attend the activities of the enterprise even on institutional holidays with total commitment. Each EL unit shall have the organizational set-up as follows:

Chief Executive Officer- HoD
Managing Director – Senior Teacher in the group
Board of Directors – Other teachers in the group
Manager – Student representative from the group
Deputy Manager – Another student from the group

6. Mid-semester examination (MSE)

6.1. MSE will be conducted as per the Timetable prepared by the Dean,school of Agriculture. For every subject, two question papers should be prepared by the faculty nominated by the respective head of the departments two weeks before the commencement of MSE.

6.2. Writing the mid-semester examination is a pre-requisite for writing the final theory and practical examinations. If a student does not appear for MSE, he/she is not eligible to appear for the final examination. Such candidate has to reappear for the MSE as and when the respective examinations are conducted only after getting permission from theDean, school of Agriculture. MSE will be conducted by the Dean, school of Agriculture. The answer scripts will be shown to the student after valuation and returned to the course teacher. The Head of the Department/Division will be responsible to ensure the distribution of answer papers to the students.

6.3. The MSE marks will not be shown separately in the grade sheet but will be combined with the respective final theory and practical marks. MSE marks awarded in a course will be added to the supplementary examinations also.

6.4. The MSE marks will be furnished to the Dean, school of Agriculture through Head of the Department within 10 days after the conduct of MSE. If the student is not satisfied with the award of the marks, he/she shall appeal to the Dean, within three workingdays after the announcement of marks. The appeal will be considered and the results reviewed by a Cell consisting of the Dean and the Head of the Department /Division of Studies concerned. The decision of the Review Cell shall be final. If the Head of the Department himself is the course teacher, one senior member of the departmentconcerned shall be nominated by the Dean.

6.5. The MSE of theory will be one hour duration. For courses with both theory and practical, 20 marks will be apportioned as shown below.

	Model	Marks
i.	Definition @ 1 mark for 5 questions out of 7	5
ii.	Short notes @ 2 marks for 5 questions out of 7	10
iii	Essay type @ 5 marks for 1 question out of 2	5
	Total	**20**

For courses with only Theory, 40 marks will be apportioned as shown below.

	Model	Marks
i.	Definition @ 2 marks for 5 questions out of 7	10
ii.	Short notes @ 3 marks for 5 questions out of 7	15
iii	Essay type @ 7.5 marks for 2 questions out of 3	15
	Total	**40**

For courses with only practicals, 40 marks will be apportioned as shown below.

	Model	Marks
i.	Definition @ 1 mark for 5 questions out of 7	5
ii.	Short notes @ 2 marks for 5 questions out of 7	10
iii	Essay type @ 5 marks for 1 question out of 2	5
iv	Practical activity/Field evaluation	20
	Total	**40**

6.6. If the student is not able to write the MSE due to deputation by the University, he/she may be permitted to take up missing MSE. Such examination should be completed ordinarily within 15 working days after the respective MSE.

6.7. A student who fails to attend a mid-semester examination due to unavoidable circumstances /who doesn't secure 65% marks in the MSE shall be permitted toreappear once with prior approval of the Dean to take up missing examination/reappearance of the particular course, on payment of fee prescribed by the University. Such tests should be completed ordinarily within 15 working days after the respective MSE. In such case the marks obtained in the reappear MSE is final.

7. Final examinations

7.1. The final theory and practical examinations will be of three hours duration each.

7.2. Theory examinations will be conducted after practical examinations.

7.3. The question papers for the final theory examinations will be set as per Bloom's taxonomy by the course teacher nominated by the concerned Head of the Department.For courses with theory and practical, the 40 marks for the theory examination will be apportioned as shown below.

	Model	Marks
i.	Objective type @ ½ mark for 10 questions out of 12	5
ii.	Definition @ 1 mark for 5 questions out of 7	5
	Short notes @ 2½ marks for 2 questions out of 3	5

iv	Essay type @ 5 marks for 5 questions (Either or pattern from each Unit) (one question must representK7 level of Bloom's taxonomy)	25
	Total	**40**

For courses with only Theory, 60 marks will be apportioned as shown below.

	Model	**Marks**
i.	Objective type @ 1 mark for 10 questions out of 12	10
ii.	Define / Explain @ 2 marks for 5 questions out of 7	10
iii	Short notes @ 3 marks for 5 questions out of 7	15
iv	Essay type @ 5 marks for 5 questions (either or pattern from each Unit) (one question must representK6 level of blooms taxonomy)	25
	Total	**60**

7.4. Central valuation of answer books will be done by examiners on the advice of the Chairman, Board of Examiners.

7.5. **Practical examination** will be conducted separately towards the end of each semester. Practical examination will be conducted separately as per the schedule proposed by the Dean, school of Agriculture and approved by the University. Proper maintenance and regular submission of practical records are required. Those who do not bring with them the certified practical records/specimen collection/assignments will not be allowed to appear for the practical examination. The marks awarded for specimen collection and assignments shall be noted in the record, at the time of first appearance and will be taken into account for subsequent appearances. Such marks awarded by the examiner will be furnished to the Head of the Department.

For the courses with theory and practical, the 40 marks for the final practical examination will be apportioned as mentioned below:

	Model	**Marks**
i.	Practical activity	25
ii.	Specimen collection / Assignment	5
iii	Record Notebook	5
iv	Viva-voce	5
	Total	**40**

7.6. If a student secures a 'pass' in the practical examination of a particular course and failsin the theory examination, then, the practical examination marks obtained in the first attempt will be added to the supplementary examinations also and he/she doesn't require to reappear for practical examination.

7.7. If a student fails in practical examination of a particular subject, then he/she should reappear for both practical and theory examination.

7.8. For student READY components, the final examination will be conducted at the end of the 8th semester

7.9. Two examiners and one skilled assistant nominated by Head of the Department and recommended by the Dean, school of Agriculture will conduct the practical examination.

7.10. Students should posses hall ticket for writing practical and final examinations.

8. Re-appearance in the examination

8.1. As per the clause 11.6 and 11.7, re-appearance for the theory and practical examinations will be permitted (retaining marks obtained in mid-semester examination)

after the payment of fee prescribed by the University. A student is permitted to write reappearance

examination for the failed subjects only three times during n+4 years duration excluding the regular final examination. In the event of a student failing to secure a pass in the three re-examinations permitted, he/she has to reregister the course along with juniors.

8.2. A student who failed in a course (subject) or awarded EE can take up re-examination without undergoing regular classes. A student who has not fulfilled attendance requirement should repeat the course to earn attendance before he/she is permitted to proceed to the next semester.

8.3. The camp requirement in NSS and NCC may be allowed along with juniors if the student has secured less than 80 % attendance in the regular courses.

8.4. Those who miss the study tours for any valid reason must undertake the tour along withjuniors to complete the degree programme.

8.5. A continuing candidate cannot appear for more than six subjects in the reappearance examination at a time. The candidate who has completed the tenure of four years in the B.Sc. (Hons) Agriculture Degree Programme (private candidate) cannot appear formore than 16 subjects in the reappearance examination at a time.

8.6. The candidates for Faculty the reappearance examinations will submit their applications through the Dean, school of Agriculture who will scrutinize the applications to ensure compliance of regulation 12.1. The attested copy of all grade sheets pertaining to the reappearance examinations should be enclosed along with the applications.

9. Malpractices in examinations

9.1. The Dean, school of Agriculture shall be responsible for dealing all cases of unfair means by students in writing records, assignments and examinations.

9.2. The invigilator or the course teacher concerned shall report each case of unfair means with full details of the evidence and written explanation of the student concerned to the Dean immediately.

10. The Dean shall take appropriate steps on receipt of the report and the report will besent to the Controller of Examinations for appropriate action as prescribed by theUniversity.Award of degree

The degree namely B.Sc. (Hons) Agriculture shall be awarded during convocation under the seal of the University to the students who have successfully completed the entire graduation requirement as detailed below.

The candidates should have undergone successfully the prescribed course of study in the University. They shall further be required to have completed 184 course credits and shall have earned an overall grade point average (OGPA) of 6.50 out of 10 for all courses completed in B.Sc. (Hons) Agriculture degree programme.

In addition to the above, students shall, in the judgment of the faculty, possess good conduct and character.

The University shall issue Provisional Certificate (PC) to the candidates after having passed all provisional examinations.

10.1. Percentage equivalence and Class ranking

10.2.

In calculation of percentage and class equivalent for OGPA, the following formula shallbe adopted.

$$\text{Percentage equivalent for OGPA} = \frac{\text{Sum of marks obtained by the candidates inall the Courses}}{\text{Sum of maximum marks in all the Courses}} \times 100$$

In calculation of percentage and class equivalent for OGPA the followingclassification shall be adopted.

OGPA	Percentage	Class
9.00 and above	90.00 and above	Distinction
8.00 to 8.99	80.00 to 89.99	I Class
7.00 to 7.99	70.00 to 79.00	II Class
6.50 to 6.99	65.00 to 69.99	Pass

11. Transitory Regulations

Separate time table of course work under old semester system will be arranged by the HOD. for students with attendance deficiency in a course/courses provided suchcourse/courses are not currently offered due to the introduction of the revised syllabi with effect from the academic year 2023– 2024. The candidates under old semester system will, however, complete all the examinations within a period of eight academic years from the year of admission.

12. Removal of difficulties

If any difficulty arises in giving effect to the provisions of these regulations, based on the recommendations of the Dean, the Vice-Chancellor may issue necessary orders, which appear to him to be necessary or expedient for removing the difficulty.

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B.Sc. (Hons) Agriculture
PROGRAMME OUTCOME
1. Graduates will acquire detailed basic and applied knowledge on crop cultivation,crop improvement, seed production, management of abiotic-stress, reclamation,plant protection, farm machinery, renewable energy, livestock production and allied socioeconomic aspects concerned with field and horticultural crops and necessary skills and hands on experience for entrepreneurship venture, cost of cultivation, higher studies and research in all frontier areas of agriculture.
2. Graduates will be able to develop expertise in the various techniques and illustrate efficiency in identifying symptoms & pests, farm budgeting, weatheranalysis, irrigation and nutrient management.
3. Graduates will be successful professionals in agro-industries with problem solvingskills, critical thinking, market intelligence and decision-making and will be able toorganize, facilitate and participate effectively and demonstrate innovativeness and creativity.
4. Graduates will function as an effective member or leader in diverse teams of knowledge dissemination regarding various farming techniques and commercialaspects of agriculture.
5. Graduates will learn appropriate traditional/Indigenous/organic and modern techniques and understand the current problems which are necessary for futuregoals in agriculture. Further, they will have absolute idea about energy flow, waste management, environment related enforcements and eco system management.
6. Graduates will gain accurate and relevant analytical skills of problems and willhave capacity to interpret information, analyze data and draw appropriate statistical conclusions, respond and adapt to changing situations and to understand the ethical standards.

PO and Co Mapping Matrix

Correlation levels 1, 2 and 3 are as defined below:

1 – Low, 2- Moderate/ Medium, 3 - Substantial /High

IV Year	Skill and entrepreneurship development (For federating Trading)
I year	Basic and fundamental courses (Traditional)
II Year	Principles (Technology)
III Year	Production system (For improving Talent)

Summary of credit hours

S. No.	Title	Credit
1	Core Courses	137
2	Elective courses	9
3	RAWE & ELP	40
	Total	**186**

Abstract of Distribution Pattern of Courses and Credit

Semester	Number of Courses	Credit
I	11	24 (14+10)
II	10	24 (15+9)
III	11	24 (13+11)
IV	10	25 (14+11)
V	11	24 (13+11)
VI	10	24 (15+9)
VII & VIII	4	41 (0+41)
Total		**186 (85+101)**

Discipline-wise Summary of Credit hours

S.No.	Discipline	Credit
1	Agronomy	23 (12+11)
2	Genetics & Plant Breeding	16 (10+6)
3	Soil Science & Agricultural Chemistry	10 (6+4)
4	Entomology	11 (7+4)
5	Plant pathology	12 (8+4)
6	Horticulture	13 (8+5)
7	Agricultural Microbiology	8 (5+3)
8	Agricultural Economics	11 (7+4)
9	Agricultural Extension	9 (6+3)
10	Animal Husbandry	4 (2+2)
11	Engineering	4 (2+2)
12	Plant Biochemistry and Biotechnology	2 (1+1)
13	Statistics	2 (1+1)
14	Computer Science	2 (1+1)
15	English	2 (2+0)
16	NSS/NCC/Physical Education & Yoga Practices*	2 (0+2)
17	Human Values and Ethics*	1 (1+0)
18	Educational Tour*	2 (0+2)
19	Tamil / Agricultural Heritage*	1 (1+0)
20	Elective courses	9 (6+3)
21	General	2(1+1)
22	Bridge Courses	-
	Total	**146**
23	RAWE & ELP	40
	Total	**186**

* Non-gradial courses

Elective Courses

A student can select three courses out of the following elective courses offered during 4th, 5th and 6th semesters. Student will elect one course in each semester out of them. 3 or 4 elective courses will be offered in each semester i.e. in 4th, 5th and 6th semester.

S.No.	Department	Code	Courses	Credit
1	Agronomy	23ECAGR305	System Simulation and Agro-advisory	3 (2+1)
2	Genetics and Plant Breeding	23ECGPB203	Commercial Plant Breeding	3 (2+1)
3	Soil Science and Agricultural Chemistry	23ECSOL202	Agrochemicals	3 (2+1)
4	Entomology	23ECENT202	Urban Entomology	3 (2+1)
5	Plant Pathology	23ECPAT302	Antagonistic formulations	3 (2+1)
6	Horticulture	23ECHOR301	Hi-tech Horticulture	3 (2+1)
7	Agricultural Microbiology	23ECAGM301	Bio pesticides and Bio Fertilizers	3 (2+1)
8	Agricultural Economics	23ECAEC203	Project Management	3 (2+1)
9	Agricultural Extension	23ECEXT303	Agricultural Journalism	3 (2+1)
10	Animal Husbandry	23ECAHS301	Caprine and Ovine Management	3 (2+1)

Bridge courses

Bridge courses in biology and mathematics will be conducted for those candidates who have not undergone the respective courses during their higher secondary programme. These courses will be offered for 8 weeks @ 2 hours /week from the date of commencement of the programme.

Sl. No.	Semester	Coursecode	Title	Credit
1.	I	23MAT 001**	Elementary Mathematics (Contact Hours 2)	-
2.	I	23GPB 002**	Introductory Biology (Contact Hours 2)	-

Non Gradial Compulsory Courses

Sl. No.	Semester	Course code	Title	Credit
1	I, II	23PEY 111*	Physical Education & Yoga	1(0+1)
2	I, II, III, IV	23NSS 111*/23 NCC 111*	NSS/NCC	1(0+1)
3	I	23TAM 111*/ 23EXT 111*	Tamil / Agricultural Heritage (Agri. Extension)	1(1+0)
4	II	23EXT 112*	Human Values & Ethics (Agri. Extension)	1(1+0)
5	IV	23AGR 211*	Educational Tour I (Agronomy)	1(0+1)
6	VIII	23EXT 411*	Educational Tour II (Agri. Extension)	1(0+1)
			Total	6(1+5)

Department wise List of CoursesAgronomy

S. No.	Semester	Course code	Title	Credit
1.	I	23AGR 101	Fundamentals of Agronomy	3(2+1)
2.	II	23AGR 102	Introductory Agrometeorology & Climate change	2(1+1)
3.	II	23AGR 103	Irrigation management	2(1+1)
4.	III	23AGR 201	Weed management	2(1+1)
5.	III	23AGR 202	Introductory to forestry	2(1+1)
6.	III	23AGR 203	Crop production technology-I (kharif crops)	2(1+1)
7.	IV	23AGR204	Practical Crop Production -I	1(0+1)
8.	IV	23AGR205	Crop Production Technology -II (Rabi crops)	2(1+1)
9.	V	23AGR 301	Practical Crop Production -II	1(0+1)
10.	V	23AGR 302	Rainfed Agriculture, Watershed Management and Secondary Agriculture	3(2+1)
11.	VI	23AGR 303	Farming systems and Organic farming for sustainable agriculture	3(2+1)
			Total	23(12+11)

Genetics and Plant Breeding

Sl. No.	Semester	Course code	Title	Credit
1.	I	23GPB 101	Fundamentals of Crop Physiology	3(2+1)
2.	II	23GPB 102	Fundamentals of Genetics	3(2+1)
3.	III	23GPB 201	Fundamentals of Plant Breeding	3(2+1)
4.	IV	23GPB 202	Principles of Seed Technology	3(2+1)
5.	V	23GPB 301	Crop Improvement-I (Kharif Crops)	2(1+1)
6.	VI	23GPB 302	Crop Improvement-II (Rabi crops)	2(1+1)
			Total	16(10+6)

Soil Science and Agricultural Chemistry

Sl. No.	Semester	Course code	Title	Credit
1.	I	23SOL 101	Fundamentals of Soil Science	3(2+1)
2.	II	23SOL 102	Manures, Fertilizers and Soil Fertility Management	3(2+1)
3.	III	23SOL 201	Problem Soils and their management	2(1+1)
4.	V	23SOL 301	Geoinformatics, Nanotechnology and Precision farming	2(1+1)
			Total	10(6+4)

Entomology

S. No.	Semester	Course code	Title	Credit
1.	II	23ENT 101	Fundamentals of Entomology	3(2+1)
.2	III	23ENT 201	Management of beneficial insects and Introductory Nematology	2(1+1)
3.	V	23ENT 301	Pests of Crops and Stored Grain and their Management	3(2+1)
4.	VI	23ENT 302	Insect Ecology & Integrated pest management	3(2+1)
			Total	11(7+4)

Plant Pathology

S. No.	Semester	Course code	Title	Credit
1.	I	23PAT 101	Fundamentals of Plant Pathology	3(2+1)
2.	IV	23PAT 201	Diseases of Field and Horticultural Crops I	3(2+1)
3.	V	23PAT 301	Diseases of Field and Horticultural Crops II	3(2+1)
4.	VI	23PAT 303	Principles of Integrated DiseaseManagement	3(2+1)
			Total	12(8+4)

Horticulture

Sl. No.	Semester	Course code	Title	Credit
1.	I	23HOR 101	Fundamentals of Horticulture	2(1+1)
2.	II	23HOR 102	Production Technology for Fruit and Plantation Crops	3(2+1)
3.	III	23HOR 201	Production Technology for Vegetables, Spices and Protected Cultivation	3(2+1)
4.	IV	23HOR 202	Production Technology for Ornamental Crops, MAP and Landscaping	3(2+1)
5.	VI	23HOR 302	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
			Total	13(8+5)

Agricultural Microbiology

Sl. No.	Semester	Course code	Title	Credit
.1	I	23AGM 101	Agricultural Microbiology	3(2+1)
.2	III	23AGM 201	Principles of Food Science & Nutrition	2(1+1)
.3	IV	23AGM 202	Environmental Studies & Disaster Management	3(2+1)
			Total	8(5+3)

Agricultural Extension

Sl. No.	Semester	Course code	Title	Credit
1.	I	23EXT 101	Rural Sociology & Educational Psychology	2(2+0)
2.	II	23EXT 102	Fundamentals of Agricultural Extension Education	3(2+1)
3.	V	23EXT 301	Communication Skills and Personality Development	2(1+1)
4.	VI	EXT 302	Entrepreneurship Development and Business Communication	2(1+1)
			Total	9(6+3)

Animal Husbandry

Sl. No.	Semester	Course code	Title	Credit
1.	III	AHS 201	Livestock Management	2(1+1)
2.	IV	AHS 202	Poultry and Fisheries Management	2(1+1)
			Total	4(2+2)

Civil and Mechanical Engineering

Sl. No.	Semester	Course code	Title	Credit
1.	III	23AEG 201	Introductory Soil and Water Conservation Engineering (Civil)	2(1+1)
2.	VI	23AEG 301	Farm Machinery, Power and Renewable Energy Sources (Mech)	2(1+1)
			Total	4(2+2)

Plant Biochemistry and Bio technology

Sl. No.	Semester	Course code	Title	Credit
1	II	BIO 101	Fundamentals of Plant Biochemistry and Biotechnology	2(1+1)
			Total	2(1+1)

Statistics

Sl. No.	Semester	Course code	Title	Credit
1.	VI	STA 301	Statistical methods	2(1+1)
			Total	2(1+1)

Computer Science

Sl. No.	Semester	Course code	Title	Credit
1.	V	COM 301	Agri- Informatics	2(1+1)
			Total	2(1+1)

English

Sl. No.	Semester	Course code	Title	Credit
1	I	ENG 101	Comprehension & Communication Skillsin English	2(2+0)
			Total	2(2+0)

General

S.NO	Semester	Course code	Title	Credit
1	IV	IKS	Indian knowledge system	2(1+1)

Semester Wise Curriculum

I Semester

S. No.	Department	Course code	Title	Credit
1.	Agronomy	23AGR 101	Fundamentals of Agronomy	3(2+1)
2.	Plant Pathology	23PAT 101	Fundamentals of Plant Pathology	3(2+1)
3.	Agricultural Microbiology	23AGM 101	Agricultural Microbiology	3(2+1)
4.	Soil Science and Agricultural Chemistry	23SOL 101	Fundamentals of Soil Science	3(2+1)
5.	Genetics and Plant Breeding	23GPB 101	Fundamentals of Crop Physiology	3(2+1)
6.	Horticulture	23HOR 101	Fundamentals of Horticulture	2(1+1)
7.	Agricultural Extension	23EXT 101	Rural Sociology & Educational Psychology	2(2+0)
8.	English	23ENG 101	Comprehension & Communication Skills in English	2(2+0)
			Total	**21(14+7)**
9.	Tamil/ Agricultural Extension	23TAM 111*/23EXT 111*	**23TAM 101 தமிழ்இலக்கியம் - நவீனத்துவமும் இலக்கியச்சரித்திரமும்** Agricultural Heritage	1(1+0)
10.		23NSS 111*/ 23NCC 111*	NSS/NCC	1(0+1)
11.	Physical Education/ Centre for Yoga Studies	23PEY 111*	Physical Education & Yoga practice	1(0+1)
			Total	**3(1+2)**
	Maths	23MAT 001**	Elementary Mathematics	
	Genetics and Plant Breeding	23GPB 002**	Introductory Biology	
			Total	**24(14+10)**
***Non Gradial course, ** Bridge Course**				

IISemester

Sl. No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 102	Introductory Agrometeorology & Climate change	2(1+1)
2	Agronomy	23AGR 103	Irrigation management	2(1+1)
3	Entomology	23ENT 101	Fundamentals of Entomology	3(2+1)

4	Bio chemistry	23BIO 101	Fundamentals of Plant Biochemistry and Biotechnology	2(1+1)
5	Genetics and Plant Breeding	23GPB 102	Fundamentals of Genetics	3(2+1)
6	Soil Science and Agricultural Chemistry	23SAC 102	Manures, Fertilizers and Soil Fertility Management	3(2+1)
7	Horticulture	23HOR 102	Production Technology for Fruit and Plantation Crops	3(2+1)
8	Agricultural Extension	23EXT 102	Fundamentals of Agricultural Extension Education	3(2+1)
9	Agricultural Economics	23AEC 101	Fundamentals of Agricultural Economics	2(1+1)
10	Agril. Extension	23EXT 111*	Human Values & Ethics (Non Gradial Course)	1(1+0)
			Total	**24(15+9)**

IIISemester

Sl. No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 201	Weed management	2(1+1)
2	Agronomy	23AGR 202	Introductory Forestry	2(1+1)
3	Agronomy	23AGR 203	Crop production technology-I (kharif crops)	2(1+1)
4	Entomology	23ENT 201	Management of beneficial insects and Introductory Nematology	2(1+1)
5	Soil Science and Agricultural Chemistry	23SOL 201	Problematic Soils and theirmanagement	2(1+1)
6	Genetics and Plant Breeding	23GPB 201	Fundamentals of Plant Breeding	3(2+1)
7	Microbiology	23AGM 201	Principles of Food Science and Nutrition	2(1+1)
8	Horticulture	23HOR 201	Production Technology for Vegetables, Spices and Protected Cultivation	3(2+1)
9	Agricultural Economics	23AEC 201	Farm Management, Production & Resource Economics	2(1+1)
10	Animal Husbandry	23AHS 201	Livestock Management	2(1+1)

11	Engineering	23AEG 201	Introductory Soil and Water Conservation Engineering (Civil)	2(1+1)
			Total	24(13+11)

IVSemester

Sl. No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 204	Practical Crop Production -I (Kharif Crops)	1(0+1)
2	Agronomy	23AGR 205	Crop Production Technology -II (Rabi crops)	2(1+1)
3	Plant Pathology	23PAT 201	Diseases of Field and horticultural Crops and their Management - I	3(2+1)
4	Agricultural Microbiology	23AGM 202	Environmental Studies & Disaster Management	3(2+1)
5	Genetics and Plant Breeding	23GPB 202	Principles of Seed Technology	3(2+1)
6	Horticulture	23HOR 202	Production Technology for Ornamental Crops, MAP and Landscaping	3(2+1)
7	Agricultural Economics	23AEC 202	Agricultural Marketing, Trade & Prices	2(1+1)
8	Animal Husbandry	23AHS 202	Poultry and Fisheries Management	2(1+1)
9	Elective 1	23ECENT202 23ECAEC 203 23ECSAC 202	Urban Entomology (Ent) Project Management (AEC) Agrochemicals (SS&AC)	3(2+1)
10	Agronomy	23AGR 211*	Educational tour I (Non Gradial Course)	1(0+1)
11	General	23IKS201	Indian knowledge system	2(1+1)
			Total	25(14+11)

***** AGR 211 Educational Tour I (0+1) (Agronomy) will be offered either during III or IV semester.

V Semester

Sl.No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 301	Practical Crop Production -II	1(0+1)
2	Agronomy	23AGR 302	Rainfed Agriculture, Watershed Management and Secondary Agriculture	3(2+1)
3	Entomology	23ENT 301	Pests of Crops and Stored Grain and their Management	3(2+1)
4	Plant Pathology	23PAT 301	Diseases of Field and horticultural Crops and their Management - II	3(2+1)
5	Soil Science and Agricultural Chemistry	23SOL 301	Geoinformatics, Nanotechnology and Precision Farming	2(1+1)

6	Genetics and Plant Breeding	23GPB 301	Crop Improvement-I (Kharif Crops)	2(1+1)
7	Agricultural Economics	23AEC 301	Agri business Management	2(1+1)
8	Agricultural Economics	23AEC 302	Intellectual Property Rights	1(1+0)
9	Agricultural Extension	23EXT 301	Communication Skills and Personality Development	2(1+1)
10	Computer science	23COM 301	Agri- Informatics	2(1+1)
11	Elective II	23ECPAT 302	Antagonistic formulations	3(2+1)
		23ECAGM 301	Bio pesticides and Bio Fertilizers	
		23ECGPB 302	Commercial Plant Breeding	
		23ECHOR 301	Hi-tech Horticulture	
			Total	24(14 +10)

VI Semester

Sl.No.	Department	Course code	Courses	Credit
1	Agronomy	23AGR 303	Farming systems and Organic farming for sustainable agriculture	3(2+1)
2	Entomology	23ENT 302	Insect Ecology & IPM	3(2+1)
3	Plant Pathology	23PAT 303	Principles of Integrated Disease Management	3(2+1)
4	Genetics and Plant Breeding	23GPB 302	Crop Improvement-II (Rabi crops)	2(1+1)
5	Horticulture	23HOR 302	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
6	Agricultural Extension	23EXT 302	Entrepreneurship Development and Business Communication	2(1+1)
7	Agricultural Economics	23AEC 303	Agricultural Finance, Banking and Cooperation	2(2+0)
8	Statistics	23STA 301	Statistical methods	2(1+1)
9	Engineering	23AEG 301	Farm Machinery, Power and Renewable Energy Sources (Mech)	2(1+1)
10	Elective 3	23ECAGR 305 23ECEXT 303 23EC AHS 301	System Simulation and Agro-advisory (AGR) Agricultural Journalism (AEX) Caprine and Ovine management (AHS)	3(2+1)
			Total	24(15+9)

VII&VIII Semesters

1. Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
2. Rural Agriculture Work Experience (RAWE) 10 credits (10 weeks)

3. In Plant Training/Industrial attachment - 10 credits (10 weeks)
4. EXT 411* –Educational Tour (0+1) (Agricultural Extension) (Non-Gradial course)

I Semester
Semester wise Curriculum

23 AGR 101 FUNDAMENTALS OF AGRONOMY (2+1)

earning objectives

- To know about the basic principles and practices of crop production
- To gain knowledge on various agricultural development from ancient to modern age
- To understand about various factors affecting crop production
- To acquire knowledge on basic agricultural operations viz., seeds and sowing, after cultivation practices, irrigation and nutrient management
- To obtain awareness on harvesting, cleaning and storage of agricultural products.

Theory

Unit I: Introduction to agriculture and Agronomy

Agriculture- definition, importance and scope-Branches of Agriculture-National and International Agricultural Institutes -Evolution of man and Agriculture. History of Agricultural development in the World, India and Tamil Nadu. Agronomy- definition, importance, meaning and scope.

Unit II: Crop distribution and production

Crop adaptation and distribution of crops – classification of crops - economic and agronomic. Major crops of India and Tamil Nadu. Major soils of Tamil Nadu. Factors affecting crop production; climatic, edaphic, biotic, physiographic and socio economic.

Unit III: Concepts of agricultural operations, planting methods and geometry

Tillage- definition, types, objectives, modern concepts of tillage. Nursery and main field preparation. Seeds-seed rate, sowing methods, crop establishment methods. Planting geometry and its effect on growth and yield. After cultivation, thinning, gap filling.

Unit IV: Weed and irrigation management

Weed- classification of weeds. Weed control methods, integrated weed management. Irrigation source-irrigation methods- macro and micro irrigation. Drainage and its importance inagriculture.

Unit V: Nutrient management and farming systems

Manures and fertilizers (organic, in-organic, green manure) time and method of application- Nutrient Use Efficiency (NUE) – Agronomic interventions for enhancing NUE. Croppingpatterns and cropping systems- Sustainable Agriculture. Integrated Farming System. Organic Agriculture-principles and concepts. Dry farming- principles and concepts. Harvesting and Post-Harvest Technology. Current stream of thoughts.

Practicals

Visit to Experimental farm –Identification of seeds and crops- Crop classification. Identification and study of manures and fertilizers - working out seed rate - Study of seed treatmentpractices. Study of tillage implements (primary, secondary and special purpose)- Practicing methods of fertilizer applications and its calculations - Different methods of sowing - Study of seeding implements - Study of inter-cultivation implements and practice - Participation in ongoing field operations.

Lesson plan

Theory Schedule

1. Definition of Agriculture – meaning and scope of Agriculture
2. Branches of Agriculture and evolution of man and Agriculture –Role of Women inAgriculture
3. History of agriculture and its development in the World and India-Agricultural Institutes of importance.
4. Introduction to Agronomy, meaning, definition and its importance in agriculture

5. Crop adaptation and distribution of crops.
6. Classification and economic importance of crops.
7. Major crops of India and Tamil Nadu
8. Major soils of India and Tamil Nadu
9. Factors affecting crop production - climatic, edaphic and biotic.
10. Factors affecting crop production - physiographic and socio economic factors.
11. Definition of tillage, objectives and types
12. Primary and secondary tillage classification and intercultural operations
13. Modern concepts of tillage – nursery and main field preparations
14. Importance of tillage in agriculture and factors affecting preparatory tillage
15. Seeds - seed rate - sowing methods – time and depth of sowing of agricultural crops
16. **Mid Semester Examination**
17. Crop density – planting geometry – competition of plants
18. Intra and inter plant competition – plant population
19. Effect of plant population on growth and yield
20. Optimum plant density and planting pattern - after cultivation -thinning and gap filling
21. Definition and importance of weeds - classification of weeds
22. Control, eradication of weeds and methods of weed control
23. Different weed management practices – IWM
24. Definition of irrigation, scope and importance of irrigation.
25. Sources of irrigation - methods of irrigation
26. Micro irrigation methods – drip and sprinkler irrigation
27. Drainage and its importance in agriculture
28. Manures and fertilizers (organic, in-organic, green manure) - time and method ofapplication.
29. Nutrient Use Efficiency (NUE) – Agronomic interventions for enhancing NUE.
30. Cropping patterns and cropping systems - Sustainable Agriculture - Integrated FarmingSystems
31. Organic Agriculture - principles and concepts
32. Dry farming - principles and concepts.
33. Harvesting and threshing of major agricultural crops
34. Post-harvest processing - principles and methods and Current stream of thoughts.

Practical schedule

1. Visit to PRIST University Experimental Farm and drawing the layout.
2. Study of farm features and measurements and cropping patterns.
3. Identification of crops and seeds.
4. Practice on different methods of sowing and planting
5. Hands on training of various seed treatment practices.
6. Study of tillage implements; practicing ploughing and puddling operations.
7. Study and practicing of various inter-cultivation implements
8. Identification of manures, fertilizers and practicing fertilizer applications for differentcrops.
9. Calculations on fertilizer requirement of major crops using fertilizers and manures.
10. Foliar application and fertigation practices.
11. Computation of plant population and seed rate for major field crops.
12. Yield contributing characters and yield estimation of crops.
13. Identification of weeds in crops: techniques of weed collection and preservation.
14. Herbicide formulation and identification- herbicide label information.
15. Irrigation methods – surface and sub-surface irrigation
16. Micro irrigations – drip and sprinkler irrigation
17. Practical examination

Course Outcome

CO 1: To understand the basic principles and practices of crop production
CO 2: To gain knowledge on various agricultural development from ancient tomodern age
CO 3: To critically assess the inter relationship between crop production anddifferent factors affecting the production of crops
CO 4: To construct skills on basic agricultural operations viz., seeds andsowing, after cultivation practices, irrigation and nutrient management
CO 5: To understand about harvesting, cleaning and storage of agriculturalproducts.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	2	-	1	-
CO2	3	-	2	-	-	-
CO3	3	2	1	1	2	-
CO4	3	1	-	-	-	-
CO5	1	-	-	-	2	-

References

1. Balasubramaniyan, P. Palamiappan S.P. 2009, Principles and Practices of Agronomy,Agribios Publishers, Jodhpur.
2. Chandrasekharan, B., K. Annadurai and E. Somasundaram, 2014, Text Book ofAgronomy, Newage international (P) Limited Publishers, New Delhi.
3. ICAR. 2011. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.
4. Maliwal PL and Mundra SL. 2021. Fundamentals of Agronomy. Agrotech Publishing Academy. Udaipur.
5. Yellamanda Reddy .T and G.H. Sankara Reddy.2015. Principles of Agronomy, Kalyani Publishers , New Delhi.

e-resources

1. http://www.hillagric.ac.in/edu/coa/agronomy/lect/Teaching_Manual_on_Introductory_Crop_Production.pdf
2. http://www.newagepublishers.com/samplechapter/001757.pdf
3. https://sites.google.com/a/uasd.in/ecourse/agronomy
4. https://www.nipabooks.com/info/9789385516740/agronomy-principles-and-practices.
5. https://www.hrsacademy.in/wp-content/uploads/2017/02/Principles-of-Agronomy-and-Agricultural-Meteorology.pdf.

23 PAT 101 FUNDAMENTALS OF PLANT PATHOLOGY (2+1)

Learning objectives

- To acquaint with the basic concepts of Plant Pathology and causes of plant diseases
- To know about pathogenesis and plant defense mechanisms
- To acquire knowledge of the general characters and classification of fungal kingdom Protozoa, Chromista, Phylum Zygomycota, Ascomycota and Basidiomycota
- To acquire knowledge of the general characters of Bacteria, Virus, Virusoids, Algae, Phanerogamic parasites, nematodes and abiotic diseases.
- To learn about the growth and reproduction of plant pathogens

Theory

Unit I: Plant pathogenic organisms

Introduction – Definition- Scope and objectives of Plant Pathology – History of Plant Pathology – Koch's Postulates – Causes of plant diseases – Biotic and abiotic factors –Significance of plant diseases – Plant pathogenic organisms – protozoa, chromista,fungi, bacteria, *Candidatus* phytoplasma, spiroplasma, fastidious vascular bacteria, viruses, viroids,

virusoids, algae, phanerogamic parasites and nematodes with examplesof diseases caused by them – Abiotic disorders.

Unit II: General characters and molecular phylogeny of fungi

General characters of fungi – Fungal somatic structures, types of fungal mycelia- Modification of fungal mycelia – Reproduction in fungi (vegetative, asexual and sexual) – Disease cycle – Symptoms of fungal diseases – Classification based on molecular phylogeny. I Kingdom: Protozoa II. Kingdom: Chromista, III. Kingdom: Fungi, Phylum: Chytridiomycota, Phylum: Blastocladiomycota, Phylum: Zygomycota, Phylum:Ascomycota, Phylum: Basidiomycota.

Unit III: Bacteria, Phytoplasma Virus, Viroid, Virusoid, Algae, Phanerogamic Plant Parasites and Abiotic disorders

Classification of bacteria - general characters and symptoms of phytopathogenic bacteria- growth and reproduction - mode of entry and spread- general characters and symptoms of *Candidatus* phytoplasma, spiroplasma, fastidious vascular bacteria, viruses - virus vector relationship-symptoms and transmission of viral diseases - viroids, virusoid, algae- flowering plant parasites - Abiotic disorders.

Unit IV: Nematodes

General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (*Heterodera, Meloidogyne, Anguina, Radopholus* etc.).

Unit V: Growth and reproduction of plant pathogens

Pathogenesis –Pre-penetration, Penetration and Post penetration – Mode of infection, survival and Spread - Effect of pathogen on physiological functions of the plants – Role of enzymes and toxins on disease development – Epidemiological factors affecting disease development - Plant defence mechanisms. Principles and methods of plant disease management. Nature, chemical combinations, classification, mode of action andformulations of fungicides and antibiotics.

Practicals

Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium*, *Phytophthora*, *Albugo*, *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora* and *Plasmopara, Synchytrium, Physoderma, Mucor*, *Rhizopus*, *Taphrina, Capnodium, Cercospora,* (*Mycosphaerella*), *Diplodia, Botryodiplodia* (*Botryosphaeria*), *Curvularia*, *Drechslera* (*Helminthosporium)*, *Alternaria*, *Venturia, Erysiphe*, *Phyllactinia*, *Uncinula*, *Leveillula* and *Claviceps*, *Fusarium* (*Gibberella, Nectria*), *Verticillium, Colletotrichum (Glomerella) Pestalotia (Pestalosphaeria), Pyricularia*(*Magnoporthe*), *Sarocladium, Macrophomina, Puccinia*, *Uromyces*, *Hemileia, Ustilago, Sphacelotheca (Sporisorium), Tolyposporium (Moesziomyces), Exobasidium, Sclerotium, Rhizoctonia* (*Thanatephorus*), *Ganoderma, Agaricus*, *Pleurotus*, *Volvariella* and *Calocybe.* Symptoms of bacterial diseases, *Candidatus* phytoplasma, fastidiousvascular bacteria, viruses, virus vector relationship-symptoms and transmission of viral diseases - viroids, virusoid, spiroplasma, algal parasite, phanerogamic parasites, nematodes (*Heterodera*, *Meloidogyne*, *Anguine*, *Radopholus* etc.) and non-parasitic diseases. Nature, chemical combination, classification, mode of action and formulations offungicides and antibiotics.

Note: Students should submit 50 well-preserved Herbarium specimens**.**

Lesson plan

Theory schedule

1. Definition of Plant Pathology – History of Plant Pathology, Koch's Postulates
2. Causes of plant diseases – Protozoa, Chromista, fungi, bacteria, fastidious vascularbacteria, spiroplasma, *Candidatus* phytoplasma
3. Causes of Plant diseases - virus, viroid, virusoid, algal, phanerogamic plant parasites, nematodes and abiotic disorders
4. General characters of fungi- Mycelia – vegetative resting structures
5. Asexual and Sexual reproduction in fungi

6. Parasitism in fungi- Types of parasitism – parasite, saprophyte, obligate parasite, facultative parasite, obligate saprophytes, facultative saprophyte-biotrophs, hemibiotrophs, perthotrophs/ necrotrophs and symbiosis
7. Classification of Kingdom– Protozoa - important taxonomic characters, symptoms andlife cycle of *Plasmodiophora brassicae* and symptoms of Protozoan diseases
8. Classification of Kingdom Chromista- General characters of Oomycetes - symptoms and life cycle of *Pythium, Phytophthora* and *Albugo*
9. Symptoms and life cycle of *Peronosclerospora, Sclerospora, Perenospora, Pseudoperenospora* and *Plasmopara*
10. Classification of Kingdom– Chytridiomycota and Zygomycota - important characters, symptoms and life cycles of *Synchytrium, Rhizopus, Mucor* and *Physoderma*
11. Classification of Kingdom– Ascomycota- important characters - Symptoms and life cycles of *Taphrina, Capnodium, Cercospora,* (*Mycosphaerella*), *Diplodia, Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium*), *Alternaria, Venturia* and *Macrophomina*
12. Symptoms and life cycles of *Eurotium, Talaromyces*, *Erysiphe, Leveillula, Phyllactinia, Uncinula, Podosphaera* and *Sphaerotheca*
13. Symptoms and important characters of *Claviceps, Fusarium* (*Gibberella, Nectria*) and *Verticillium, Colletotrichum (Glomerella), Pestalotia (Pestalosphaeria), Pyricularia* (*Magnoporthe*) and *Sarocladium*
14. Classification of Kingdom - Basidiomycota- important characters, Symptoms and life cycles of *Puccinia, Uromyces* and *Hemileia*
15. Symptoms and life cycles of *Ustilago, Sphacelotheca (Sporisorium), Tolyposporium (Moesziomyces), Tilletia* and *Exobasidium*
16. Symptoms and life cycles of *Athelium, Thanatephorus* and *Ganoderma*
17. Mid Semester Examination
18. Important taxonomic characters of *Agaricus, Pleurotus*, *Volvariella* and *Calocybe*
19. Classification and general characters of phytopathogenic bacteria
20. Symptoms of plant pathogenic bacteria
21. Mode of entry, spread and survival of bacterial pathogens
22. Important characters and symptoms of *Candidatus* phytoplasma diseases – phyllody,little leaf, yellow dwarf and sandal spike, fastidious vascular bacteria and spiroplasma
23. Virus - definition, nature and properties of plant virus, single stranded, doublestranded RNA and DNA viruses and transmission of plant viruses
24. Virus vector relationship-symptoms of viral diseases
25. Important characters and symptoms of viroid, virusoid, algal and phanerogamicparasites
26. Non-parasitic disorders
27. General morphology and reproduction of nematodes
28. Symptoms and nature of damage caused by plant nematodes (*Heterodera,Meloidogyne, Anguina, Radopholus* etc.).
29. Pathogenesis – stages in pathogenesis – pre-penetration, penetration and postpenetration
30. Role of enzymes and toxins in disease development
31. Effect of pathogen on physiological functions of the plants- Effect on photosynthesis- transpiration- respiration- translocation of water and nutrients
32. Epidemiological Factors affecting disease development
33. Plant defence mechanisms. Principles and methods of plant disease management.
34. Nature, chemical combination, classification, mode of action and formulations offungicides and antibiotics.

Practical schedule

1. General characters of fungi – Types of mycelia -Types of vegetative, asexual and sexualspores-

asexual and sexual fruiting bodies.

2. Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium* and *Phytophthora*.
3. Study of important taxonomic characters and symptoms produced by *Sclerospora*, *Peronospora*, *Peronosclerospora*, *Pseudoperonospora* and *Plasmopara*
4. Study of important taxonomic characters and symptoms produced by *Albugo*,*Synchytrium* and *Rhizopus*.
5. Study of important taxonomic characters and symptoms produced by *Taphrina*, *Capnodium*, *Cercospora* (*Mycosphaerella*), *Diplodia*, *Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium)* and *Alternaria*
6. Study of important taxonomic characters and symptoms produced by *Eurotium*, *Talaromyces*, *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Podosphaera* and *Sphaerotheca*
7. Study of important taxonomic characters and symptoms produced by *Claviceps*, *Fusarium* (*Gibberella*, *Nectria*) and *Verticillium*
8. Study of important taxonomic characters and symptoms produced by *Colletotrichum (Glomerella)*, *Pestalotia (Pestalosphaeria)*, *Pyricularia* (*Magnoporthe*), *Sarocladium* and *Macrophomina*
9. Study of important taxonomic characters and symptoms produced by *Puccinia*,*Uromyces* and *Hemileia*
10. Study of important taxonomic characters and symptoms produced by *Ustilago*, *Sphacelotheca (Sporisorium)*, *Tolyposporium (Moesziomyces)* and *Exobasidium*
11. Study of important taxonomic characters of *Agaricus*, *Pleurotus*, *Calocybe*, *Volvariella* and symptoms produced by *Athelium*, *Thanatephorus* and *Ganoderma*
12. Symptoms of bacterial diseases – leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
13. Symptoms of *Candidatus* Phytoplasma and Algae
14. Symptoms and vectors of viral diseases – mosaic, chlorosis, leaf curl, stem pitting, spotted wilt, necrosis, ring spot, vein clearing, leaf crinkle, rosette and bunchy top – diseases caused by viroids and virusoids
15. Symptoms and nature of damage caused by plant nematodes (*Heterodera*, *Meloidogyne*,*Anguina*, *Radopholus* etc.).
16. Phanerogamic plant parasites and non-parasitic diseases
17. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Assignment: Students should submit 50 well-preserved herbarium specimens.

Course outcome

CO 1: Acquainted with the basic concepts of plant pathology, Host parasite relationship of pathogens

CO 2: Having in depth knowledge of pathogenesis and plant defense mechanisms

CO 3: Having in depth knowledge of fungal kingdom Protozoa and Chromista, PhylumZygomycota, Ascomycota and Basidiomycota

CO 4: Having in depth knowledge of the general characters and pathogenicity of bacteria,virus, virusoids, algae, phanerogamic parasites, nematodes and abiotic diseases.

CO 5: Acquainted with the growth and reproduction of plant pathogens

CO – PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	2	-	1	-	-
CO 2	1	2	-	-	-	-
CO 3	2	3	-	-	-	-
CO 4	2	2	-	2	-	-
CO 5	2	2	-	-	-	-

References

1. Agrios, G.N. 2005. Plant Pathology –5th Edition. Academic Press, New York.
2. Singh R.S. 2017. 5th Edition, Introduction to Principles of Plant Pathology. Medtech Publishers.
3. Alice, D, and Jeyalakshmi, C. 2014. Plant Pathology. A.E Publications, Coimbatore
4. Dube, H.C. 2009. A Text Book of Fungi, Bacteria and Viruses, Agrobios India.
5. Vidhyasekaran, P. 1993. Principles of Plant Pathology – CBS Publishers, New Delhi.

e- resources

1. http://ecoursesonline.iasri.res.in/course/view.php?id=143
2. http://www.mycology.net
3. https://www.apsnet.org/edcenter/disandpath/prokaryote/intro/Pages/Bacteria.aspx
4. http://www.ictv.org
5. http://npic.orst.edu/ingred/ptype/fungicide.html

23AGM 101 AGRICULTURAL MICROBIOLOGY (2+1)

Learning Objectives:

- To enable better understanding of students about the microscopic world aroundthem
- To acquaint students with the basic laboratory techniques and tools ofmicrobiology
- To highlighten the role of soil microorganisms in soil fertility and plant growth promotion
- To develop experimental skills in soil microbiology which includes isolation ofbeneficial microorganisms from soil and plant and their mass production
- To understand biogeochemical cycles through the microbial transformation ofnutrients in soil

Theory

Unit - I: History and concept of Microbiology.

History and development in Agricultural Microbiology-Contributions of Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Prokaryotes Vs Eukaryotes-Biogenesis and abiogenesis- Groups of microorganisms;Morphology -Bacterialsize, shape and arrangement - Morphology of fungi and Algae.

Unit-II: Microbiological Techniques.

Microscopy – principles of light microscopy -magnification, resolving power and numerical aperture. -Different types of light and electron microscope; Staining techniques – principle and types of stain-simple, negative and differential staining. Sterilization and disinfection techniques; Principles and methods of sterilization – Physical methods – heat, filters and radiation; Chemical methods; Isolation and pure culture techniques – Enrichment culture, Preservation of microbial cultures.

Unit-III: Microbial growth and Genetics.

Bacterial growth - measurement of growth and factors influencing bacterial growth –Growth curve; Nutritional types; Genetic Recombination –Transformation, Conjugation and Transduction.

Unit-IV: Soil Microbiology.

Distribution and importance of soil microorganisms in soil fertility – factors affecting the activities of soil microorganisms; Rhizosphere microorganisms and their importance, R:S Ratio; Phyllosphere microorganisms; Soil microorganisms Agriculturally beneficial microorganisms and their interaction -Positive and negative interaction. Plant growth promoting Rhizobacteria.

Unit-V: Microbial transformation and bioinoculants

Microbial transformation of nutrients in soil – Nitrogen Cycle-Carbon andPhosphorouscycle; Bioinoculants-importance and types-carrier based, liquid based,

-Mass production, method of applications and quality control of biofertilizers

Lesson plan

Theory Schedule

1. History and development in Agricultural Microbiology
2. Contributions of Beijerinck, Winogradsky and Waksman
3. Prokaryotes Vs Eukaryotes
4. Biogenesis and abiogenesis
5. Groups of microorganisms
6. Morphology of Bacteria- Bacterial size, shape and arrangement
7. Morphology of fungi and Algae.
8. Principles of light microscopy -magnification, resolving power and numericalaperture.
9. Different types of light and electron microscope
10. Staining techniques – principle and types of stain- simple, negative anddifferential staining.
11. Sterilization and disinfection techniques; Principles and methods of sterilization
12. Physical methods – heat, filters and radiation; Chemical methods
13. Isolation and pure culture techniques – Enrichment culturing,
14. Preservation of microbial cultures
15. Bacterial growth - measurement of growth
16. Factors influencing bacterial growth
17. **Mid semester examination**
18. Growth curve
19. Nutritional types
20. Genetic Recombination –Transformation
21. Conjugation and Transduction
22. Distribution and importance of soil microorganisms in soil fertility
23. Factors affecting the activities of soil microorganisms
24. Rhizosphere microorganisms Agriculturally beneficial microorganisms and their importance, R:S Ratio
25. Phyllosphere microorganisms
26. Soil microorganisms and their interactions
27. Positive and negative interaction.
28. Plant growth promoting Rhizobacteria
29. Microbial transformation of nutrients in soil – Nitrogen cycle
30. Carbon and Phosphorous cycle
31. Bioinoculants-importance and types-carrier based; liquid based
32. Mass production of biofertilizers-Bacterial Biofertilizer and AM fungi
33. Method of application and quality control of biofertilizers.
34. Current stream of thoughts

Practical Schedule

1. Introduction to microbiology laboratory and its equipments
2. Principles of microscopy- Study of compound microscope
3. Methods of sterilization.
4. Preparation of culture media and agar slant
5. Buried slide technique
6. Enumeration of microbial population in soil by bacteria, fungi and actinomycetes in soil by standard plate technique

7. Purification of bacteria
8. Purification of fungi
9. Gram staining
10. Negative staining
11. Isolation of Rhizobium from legume root nodule.
12. Isolation of Azospirillum from soil.
13. Isolation of Phospobacteria from soil.
14. Mass production of bacterial biofertilizer and quality control methods
15. Bio gas production technique
16. Microbial composting
17. Practical Examination

Course Outcomes

CO 1: The students would thoroughly understand about the role of microorganisms in soiland their influence on the plant growth production and historical perspectives.
CO 2: Further, they would enrich on the various basic microbiological techniques.
CO 3: The students exposed to soil microbial diversity and microbial genetics. **CO 4:** Thestudents would expose to the beneficial and harmful relationshipsbetween soil microorganism and different parts of plants.
CO 5: The students will gain hands on experience of production and quality control aspectsof different microbial inoculants and to have self-confidence to become successful entrepreneurship.

CO – PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	-	-
CO2	3	2	-	-	-	-
CO3	-	-	-	-	2	-
CO4	2	2	-	-	1	-
CO5	-	-	2	1	-	-

References

1. Pelczar, jr. M.J.E.C.S.Chan and Krieg. N. R, 1996, **Microbiology:** Mc graw Hill publishers, New York
2. Rangaswami G Bhagyaraj D J (2nd ed) 2001, **Agricultural Microbiology:** PrenticeHallof India Pvt Ltd., New Delhi
3. Prabhakaram. G. 2004, **Introduction to Soil & Agricultural Microbiology:** Himalaya publication house, Mumbai
4. Sullia, S.B, and Shantaram, 1998, **General Microbiology:** Oxford and IBH Publising Company, private limited, New Delhi
5. SubbaRao, N.S.1999, **Soil Microorganisms and plant Growth:** Oxford and IBH, New Delhi

e-Resources

1. https://www.microbes.info/
2. https://journals.asm.org/journal/aem
3. https://www.domainmarket.com/buynow/microbelibrary.com?_cf_chl_rt_tk=7krg9nCVT2Aqe8ze5U9Mq58bOrnCz2_yXe_JTRlqB4w-1649310409-0-gaNycGzNCCU
4. https://www.rapidmicrobiology.com/

23 SOL 101 FUNDAMENTALS OF SOIL SCIENCE (2+1)

Objectives

- To demonstrate basic knowledge of terms and concepts in soil science, apply this knowledge to new problems and situations.
- To learn the key physical, chemical, and biological aspects of soils and form a basic understanding of formative processes for different soil types and recognition of soil as a natural body.
- To learn the significance of soil microorganisms on its role in organic matter decomposition and nutrient transformation in soil
- To gain knowledge on sources of pollutants and its impact on soil pollution
- To learn the concept of soil organic matter and its role in crop growth and soil fertility

Theory

Unit–I: Earth origin and rocks

Origin of earth – theories – planetesimal and nebular hypothesis – Composition of Earth's crust. Soil forming rocks and minerals – origin – classification. Weathering of rocks and minerals – physical, chemical and biological weathering.

Unit -II: Soil formation and Soil taxonomy

Soil formation – soil forming factors – active and passive. Soil forming processes – fundamental and specific soil forming processes. Soil profile – master horizons, subordinate horizons – Definition of soil – Soil composition Pedalogical and Edaphological concepts. Elementary knowledge of soil taxonomy and classification- Soils of India and Tamilnadu.

Unit-III –Soil physical properties I

Soil physical properties and their significance – Soil texture – classification of soil separates, properties of soil separates, Particle size analysis – Stokes law assumptions and limitations,

textural classes. Soil structure – classification, soil aggregates, evaluation of soil structure, significance. Pore space types, factors affecting porosity, manipulation. Bulk density andparticle density – relationships, factors, significance and manipulation. Soil colour – factors, attributes and significance. Soil consistency – forms, factors, limits and significance.

Unit–IV Soil physical properties –II

Soil water classification, potentials, Soil moisture constants, movement of soil water – saturated and unsaturated flow – Infiltration, hydraulic conductivity, percolation, permeability. Soil air – composition, gaseous exchange, influence of soil air on plant growth. Soil temperature – thermal properties of soils, flow of heat, soil temperature regimes, influence of soil temperature on plant growth.

Unit–V Soil colloids and Soil pollution

Soil Chemical properties – Soil colloids – Properties, types and significance – Layer silicate clays – their genesis and sources of charges – Ion exchange – CEC, AEC and Base saturation – Factors influencing Ion exchange – significance. Soil reaction, Buffering capacity and EC. Soil organic matter – sources – chemical composition – decomposition – humus formation – role and functions of organic matter in soil. Soil organisms – Beneficial and harmful effects.

Soil pollution - behavior of pesticides and inorganic contaminants, prevention and mitigation ofsoil pollution. Current stream of thoughts

Lesson Plan

Lecture Schedule

1. Origin of earth – Theories – Planetesimal and Nebular hypothesis – Geological time scale – Age of earth.
2. Rocks – Definition – Classification – Igneous – Sedimentary rock – Their formation – Classification – Brief description of important rocks.
3. Metamorphic rocks – Their formation, classification and brief description of importantrocks.
4. Composition of earth's crusts – Minerals – Definition – Occurrence-classification –Formation of primary minerals – Ferro and non-ferro magnesium minerals.
5. Secondary minerals – Clay minerals. Non-silicate minerals
6. Weathering of rocks and minerals – Physical, chemical and biological weathering

7. Soil –Definitions – Soil as a natural body – Three dimensional figure – Major componentsof soil by volume – Pedology and Edaphology
8. Factors of soil formation – Active factors – Climate and biosphere
9. Passive factors of soil formation – Topography, Parent material and Time.
10. Soil forming processes-Fundamental pedogenic processes-Disintegration and decomposition of secondary minerals
11. Eluviation and illuviation-Description of typical soil profile- Master and Subordinatehorizons
12. Specific pedogenic processes-Calcification-Decalcification-Salinization- Alkalization-Podzolization-Laterization.
13. Soil taxonomy and its classification - Soils of India and Tamilnadu
14. Physical properties-Soil texture -Soil separates -Textural analysis -International pipettemethod-Stoke's law-Assumption and limitations-Textural classes using triangular diagram
15. Soil structure- Classification- types, classes and grades of soil structure- importance ofsoil structure and management.
16. Soil density - Bulk density -Particle density -Definition-Factors affecting bulk density and particle density.
17. **Mid semester examination**
18. Pore space-Definition of macro and micro pore space-Factors affecting pore space- Soil compaction-internal surface area-Factors influencing soil compaction
19. Soil strength and its importance. Soil colour-Significance- Munsell colour chart-hue, value and chroma-Factors influencing soil colour.
20. Soil consistence- consistence of wet and dry soils- Cohesion-Adhesion- Soil Crusting- Plasticity-Atterberg's constant-Upper and lower plastic limits, plastic number
21. Soil water- forces of soil water retention- pF concept- Soil moisture characteristics curves-Soil air-composition – Factors affecting composition.
22. Soil water potential- components of water potentials – soil moisture constants- Field capacity, wilting coefficient, hygroscopic water and saturation.
23. Available water and methods for determining soil moisture constants- Pressure plate and pressure membrane apparatus.
24. Soil water content- soil water movement- Darcy's law- saturated, unsaturated and vapour flows-infiltration, percolation, and permeability- Distribution of water in profile in different soils- Soil drainage and its importance.
25. Soil temperature- sources of heat- heat capacity and conductivity- factors influencing soil temperature- Soil thermal regimes- Importance on plant growth-Factors influencing soil temperature-Measurement of soil temperature.
26. Soil air- composition – atmospheric and soil air- Gaseous exchange- influence of soil air on plant growth- soil properties and nutrient availability- measurement of oxygen diffusion rate- Measures to improve soil aeration.
27. Soil colloids – Properties- Types-Secondary silicate clay minerals- Kaolinite, Montmorillonite, Illite and chlorite- Allophones.
28. Organic colloids – origin of charge- ion exchange- types- Base saturation- factors affecting ion exchange capacity of soils- importance of cation exchange capacity of soils- calculation of Base Exchange capacity and exchangeable acidity.
29. Soil reaction pH- soil acidity- soil alkalinity- Buffering capacity- effect of pH on nutrient availability.
30. Soil pH – Factors affecting soil pH – Soil pH and nutrient availability- EC – its impact on soil growth
31. Soil humus- definition- synthesis of humus- fractionation of soil humus- importance–carbon cycle-carbon: nitrogen(C:N) ratio – Significance of C : N ratio in soil fertility
32. Soil biology- Biomass- Flora and fauna- Role of beneficial organisms- soil organic matter-composition- properties- Role and functions of organic matter in soil.

33. Soil microorganisms- beneficial effects and harmful effects- Mineralization, immobilization nitrogen fixation, phosphorus solubilization, biological control of diseases, promotion of plant growth substances.
34. Soil pollution- behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Current stream of thoughts

Practical

1. Identification of common glassware's and analytical equipment's
2. Preparation of standard solution and types of titration
3. Identification of rocks and minerals.
4. A study on soil profile,
5. Collection and processing of soil samples
6. Determination of soil moisture.
7. Determination of soil bulk density, particle density, pore space in soil.
8. Estimation of soil texture (Feel method)
9. Particle size analysis – international pipette method,
10. Estimation of soil texture -Bouyoucos Hydrometer method,
11. Determination of soil colour,
12. Estimation of soil pH (theory and principles of pH meter and principles of estimation ofsoil pH)
13. Estimation of soil EC (theory and principles of EC meter and principles of estimation insoil EC)
14. Estimation of cation exchange capacity in soil.
15. Estimation of anion exchange capacity in soil.
16. Estimation of exchangeable cations and buffering capacity in soil.
17. **Practical Examination**

Course outcomes

CO 1: Students gain the knowledge origin of earth, weathering of rocks and mineralsCO 2: Students learn to explain soil formation and different soil forming processes.

CO 3: Students develop individual skills and ability to analysis the soil for Physical and Chemical properties.

CO 4 : Students learn to understand the role of microorganisms in promoting better soil healthCO 5 : Students gain knowledge on impact of various pollutants causing soil pollution

CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	-	-	1	-
CO2	-	2	-	-	1	-
CO3	2	3	3	1	1	1
CO4	1	1	-	2	2	-
CO5	-	2	-	-	2	-

References

1. Biswas, T.D. Mukherjee, S. K. 1995. Text Book of Soil Science 2nd Ed. Tata McGraw Hill,New Delhi
2. Brady, N. C. 2016. The Nature and Properties of Soils. 15th edition Publisher: Pearson Education, New Delhi
3. Das, D.K. 2015. Introductory Soil Science, 4th edition, Kalyani Publishers, New Delhi.
4. Indian Society of Soil Science. 2012. Fundamentals of Soil Science, IARI, New Delhi.
5. Sehgal J. 2015. A text book of Pedology- Concepts and Applications, Kalyani Publishers,New Delhi.

e-resources

1. http:// www.agristudy.hub.com
2. https://www.agrimoon.com
3. http://agrariangalaxy.blogspot.com
4. http://ndritoppers.blogspot.com
5. http://www.agrilearners.com

23GPB 101 - FUNDAMENTALS OF CROP PHYSIOLOGY (2+1)

Learning objectives

- To impart basic knowledge on various functions and processes related to crop production,mineral nutrition, plant growth regulators and environmental stresses.
- To understand the mechanism of absorption and translocation of water and nutrients fromthe soil.
- To study the different pathways in photosynthesis and respiration
- To study the topics on plant growth regulators and stress physiology
- To impart knowledge about selection of ideal plant type for higher crop productivity.

Theory

Unit I; Plant water relations

Importance of crop physiology in agriculture – Cell organelle- Plasma membrane, chloroplast, mitochondria, peroxisome and vacuole - Structure and role of water –Water potential and its components – diffusion – osmosis – imbibition - plasmolysis – Field Capacity and permanent wilting point- Mechanisms of water absorption – Pathways of water movement – Apoplast andSymplast - Translocation of water – ascent of sap – mechanisms - Transpiration – significance
– structure of stomatal pore- mechanisms of stomatal opening and closing – guttation – anti transpirants.

Unit II; plant mineral nutrition

Criteria of essentiality - Classification of nutrients – macro, micro, mobile, beneficial elements and immobile – mechanism of nutrient uptake- Physiological functions, deficiencies and disorders of macro and micro nutrients – Hidden hunger- Foliar nutrition- root feeding and fertigation – Sand culture, hydroponics and aeroponics

Unit III; Photosynthesis and respiration

Light reaction – Photosystems- Red drop and Emerson enhancement effect- Photolysis of water and photophosphorylation - Photosynthetic pathways – C_3 and C_4, CAM – difference between three pathways - Factors affecting photosynthesis- Photorespiration – pathway andits significance - Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations - Glycolysis – TCA cycle - Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting
- respiratory quotient.

Unit IV; Growth and development

Growth – phases of growth - factors affecting growth – Hormones- classifications - Biosynthetic pathway and role of auxins - Biosynthetic pathway and role of gibberellins and cytokinins- Biosynthetic pathway and role of ethylene and ABA- Novel and new generation PGR's – Brassinosteroids and salicylic acid - Growth retardants – Commercial uses of PGR's-Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering-Forms of phytochrome - Pr and Pfr - regulation of flowering – Vernalisation - Theories of vernalisation - Seed germination - physiological and biochemical changes - seed dormancy and breaking methods - Senescence and abscission – physiological and biochemical changes
-Physiology of fruit ripening- climacteric and non-climacteric fruits - factors affecting ripening- Manipulations

Unit V; Stress physiology

Classification of stresses - Physiological changes and adaptations to drought, flooding, high and low temperature, salinity and UV radiation – compatible osmolytes – membrane properties —

compartmentalization – stress alleviation - Global warming – green house gases – physiological effects on crops - Carbon Sequestration.

Practicals

Preparation of different types solutions -Measurement of plant water potential by different methods - Estimation of photosynthetic pigments- Chlorophylls and Carotenoids - Determination of stomatal index and stomatal frequency - Measurement of leaf area bydifferent methods - Physiological and Nutritional disorders in crops plants -Estimation ofchlorophyll Stability Index - Estimation of Relative Water Content -Determination of photosynthetic efficiency in crop plants – soluble protein - Estimation of Nitrate Reductase activity -Growth Analysis - Bioassay of Cytokinin and GA - Estimation of proline - Demonstration of Practical applications of PGRs. Field visit for foliar diagnosis

Lesson plan

Theory lecture schedule

1. Importance of Crop Physiology in Agriculture – Structure of plasma membrane,chloroplast, mitochondria, peroxisome and vacuole
2. Structure and role of water –water potential and its components – Diffusion – Osmosis – imbibition – Plasmolysis - Field Capacity and Permanent Wilting Point
3. Mechanisms of water absorption – Pathways of water movement – Apoplast and symplast
4. Translocation of water – ascent of sap – mechanisms of xylem transport
5. Transpiration – significance – structure of stomata - mechanisms of stomatal opening andclosing – guttation – anti-transpirants
6. Mineral nutrition – criteria of essentiality - classification of nutrients – macro, micro, mobileand immobile – mechanism of nutrient uptake
7. Physiological functions and disorders of macro nutrients – Hidden hunger
8. Physiological functions and disorders of micro nutrients
9. Foliar nutrition- root feeding and fertigation – sand culture, hydroponics and aeroponics
10. Light reaction – photolysis of water and photophosphorylation
11. Photosynthetic pathways – C_3 and C_4 cycles
12. CAM pathway – difference between three pathways - Factors affecting photosynthesis.
13. Photorespiration – pathway and its significance
14. Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sinkstrength and their manipulations
15. Glycolysis – TCA cycle
16. Oxidative phosphorylation – difference between photo and oxidative phosphorylation –energy budgeting - respiratory quotient
17. **Mid semester examination**
18. Growth – phases of growth – factors affecting growth – Hormones- classifications
19. Biosynthetic pathway and role of auxins
20. Biosynthetic pathway and role of gibberellins and cytokinin
21. Biosynthetic pathway and role of ethylene and ABA
22. Novel growth regulators – Brassinosteroids and salicylic acid – New Generation PGR’s
23. Growth retardants and inhibitors -commercial uses of PGR’s
24. Photoperiodism - short, long and day neutral plants – Chailakhyan’s theory of flowering
25. Forms of phytochrome - Pr and Pfr - regulation of flowering
26. Vernalisation - theories of vernalisation – Lysenko and Chailakhyan’s theories
27. Seed germination - physiological and biochemical changes - seed dormancy and breakingmethods
28. Senescence and abscission – physiological and biochemical changes
29. Physiology of fruit ripening- climacteric and non-climacteric fruits - factors affectingripening and manipulations
30. Drought - physiological changes - adaptation – compatible osmolytes - alleviation

31. High and low temperature stress – physiological changes - membrane properties -adaptation
32. Salt stress - physiological changes - adaptation – compartmentalization - alleviation
33. Flooding and UV radiation stresses – physiological changes - adaptation
34. Global warming – green house gases –-physiological effects on crop productivity- Carbon Sequestration

Practical schedule

1. Preparation of different types solutions
2. Measurement of plant water potential by different methods
3. Estimation of photosynthetic pigments- chlorophylls and Carotenoids
4. Determination of stomatal index and stomatal frequency
5. Measurement of leaf area by different methods
6. Physiological and Nutritional disorders in crops plants
7. Estimation of chlorophyll Stability Index
8. Estimation of Relative Water Content
9. Determination of photosynthetic efficiency in crop plants – soluble protein
10. Estimation of Nitrate Reductase activity
11. Growth Analysis - LAI, LAD, SLA, SLW, LAR, NAR, RGR, CGR and HI
12. Bioassay of Cytokinin
13. Bioassay of GA
14. Estimation of proline
15. Demonstration of Practical applications of PGRs.
16. Field visit for foliar diagnosis
17. **Final Practical examination**

Course Outcome

CO 1: Students will acquire basic knowledge on various functions and processes related tocrop productivity

CO 2: Will be able to identify the mineral nutrient deficiencies and their symptoms

CO 3: Know about the various plant growth regulators and environmental stresses.

CO 4: In addition, hands on exposure to preparation of solutions, analysis of pigmentcomposition, estimation of growth analytical parameters,

CO 5: Will be able to diagnose nutrient deficiencies in crops and ameliorate them and will be competent in enzyme assays and applications of plant growth regulators

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	**3**	**-**	**-**	**-**	**-**
CO 2	**-**	**3**	**-**	**-**	**-**
CO 3	**-**	**2**	**-**	**-**	**2**
CO 4	**2**	**-**	**-**	**-**	**-**
CO 5	**-**	**-**	**-**	**-**	**-**

References

1. Boominathan, P., R. Sivakumar, A. Senthil, and D. Vijayalakshmi. 2014. Introduction toPlant Physiology, A.E. Publications. Coimbatore
2. Jain, V.K. 2007. Fundamentals of plant physiology, S.Chand and Company Ltd., NewDelhi.
3. Taiz. L. and Zeiger. E., 2010 (Fifth edition). Plant Physiology. Publishers: SinauerAssociates, Inc., Massachusetts, USA.
4. Sabesan, T., S. Suganthi, P. Satheeshkumar and R. Narayanan. 2015. Introduction toCrop Physiology. Manibharathi Publishers, Chidambaram.
5. Ahmad Shah, R. 2021. Fundamentals of Crop Physiology. Kushal Publications, New Delhi

e-Resources

1. https://k8449r.weebly.com/uploads/3/0/7/3/30731055/crop_physiology.pdf
2. http://www.jnkvv.org/PDF/01042020110659physio%20class%20notes.pdf
3. https://agrimoon.com/wp-content/uploads/Crop-Physiology.pdf
4. https://drive.google.com/file/d/1HFRV-undtnUGLIvv5wAwyHODR28GmoTF/view
5. https://drive.google.com/file/d/1QTqWSdYkJ37PGSVLQyXA3PsOlEdeGn-r/view

23HOR 101 FUNDAMENTALS OF HORTICULTURE (1+1)

Learning objectives

- To impart knowledge on fundamentals of horticulture
- To learn about the importance, branches, layout of an orchard, special horticulture techniques for horticultural crops.
- To learn about the sexual and asexual Propagation techniques.
- Learn about the different tools and their use in propagation of horticultural crops and identification of horticultural crops.

Theory

Unit I: Basic concepts of Horticulture: Horticulture - Its definition and branches, importanceand scope. Horticultural and botanical classification. Climate and soil for horticultural crops. Horticulture zones of India and Tamil nadu.

Unit II: Propagation Methods and Structures: Plant propagation-methods and propagating structures. Seed dormancy, Seed germination, principles of orchard establishment.

Unit III: Training and Pruning: Principles and methods of training and pruning, juvenility and flower bud differentiation, unfruitfulness.

Unit IV: Pollination: Pollination, Pollinizers and Pollinators. Fertilization and Parthenocarpy.

Unit V: Growth regulators: Importance of plant bio-regulators in horticulture. Irrigation –methods, Fertilizer application in horticultural crops.

Practicals

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation including micro-propagation. Layout and planting of orchard. Training and pruning of fruit trees. Preparation ofpotting mixture. Fertilizer application in different crops. Visits to commercial nurseries/orchard. **Lesson plan**

Theory Schedule

1. Horticulture - Its definition.
2. Branches of Horticulture.
3. Importance and Scope of horticulture.
4. Horticultural and botanical classification.
5. Climate and soil for horticultural crops.
6. Plant propagation-methods and propagating structures.
7. Seed dormancy, Seed germination.
8. Principles of orchard establishment.
9. **Mid – Semester Examination**
10. Principles and methods of training.
11. Principles and methods of pruning.
12. Juvenility and flower bud differentiation, Unfruitfulness.
13. Pollination, Pollinizers and Pollinators
14. Fertilization and Parthenocarpy.
15. Importance of plant bio-regulators in horticulture.
16. Irrigation – methods.
17. Fertilizer application in horticultural crops.

Practical Schedule

1. Identification of horticultural crops.

2. Acquiring knowledge about Layout and planting of an orchard
3. Acquiring knowledge and identification of garden tools.
4. Practicing Preparation of seed bed/ nursery bed
5. Practicing preparation of potting mixture.
6. Practicing sexual methods of propagation.
7. Acquiring knowledge about uses of plant parts used in Vegetative propagation.
8. Practicing asexual propagation by different methods of Cutting and Layering.
9. Practicing asexual propagation by different methods of Budding and Grafting.
10. Learning about the micropropagation techniques.
11. Practicing training and pruning of fruit trees.
12. Fertilizer application in different crops.
13. Visits to commercial nurseries/orchard.
14. End semester practical examination.

Course outcome

CO 1: The student will gain knowledge on branches of horticulture and the climaticrequirements of horticulture Crops

CO 2: The student will acquire skill on different propagation methods of horticulture crops

CO 3: The student will acquire knowledge on establishment and management of orchardcrops

CO 4: The students will gain skills on training, pruning and crop regulations of horticulturecrops

CO5: The students will acquire knowledge on bearing habits and factors influencing onfruitfulness

CO-PO MAPPING MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	1	0	1	2	0
CO 2	3	2	0	0	1	0
CO 3	2	1	0	3	1	0
CO 4	2	2	1	2	1	0
CO 5	3	2	0	2	2	0

References

1. Adams C.R., K.H. Bradford, M.P. Early. 1996. Principles of Horticulture. CBS Publishersand Distributors, New Delhi.
2. Christopher, E.P. 2001. Introductory Horticulture. Biotech Books, New Delhi.
3. Edmond J.B., A.M. Musser and F.S. Andrews. 1975. Fundamentals of Horticulture. Tata McGraw Hill Publishing Co., New Delhi.
4. Hartman. H.T. and D.E. Kester. 1976. Plant Propagation – Principles and Practices.Prentice Hall of India Ltd., New Delhi.
5. Janic, J.W.H., 1988. Horticultural Science. Freeman and Co., San Francisco.

e- References

1. http://aggie-horticulture,tamu.edu/propagation/propagation.html
2. http://www/britannica.com/
3. http://www.horticulture.com.au/export/hmac.asp
4. http://www.horticultureworld.net/hort-india.htm
5. http://www.fao.org/

23EXT - 101 RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY (2+0)

Learning Objectives

- To acquire knowledge on basic concepts of rural sociology and educational psychology
- To understand the social structure and social stratification and social groups: their typesand characteristics
- To gain knowledge on the concepts of migration and its impact on society

- To understand the concepts of social control and social change
- To gain knowledge on teaching–learning process and basic principles of human behaviourand personality

Theory

UNIT I: Introduction to Sociology, Social groups, Culture and Social Values

Sociology and rural sociology – definitions; society – rural and urban, characteristics, differences and relationships, important characteristics of Indian rural society; social groups – definition, classification, role of social groups in extension; culture – concept, cultural traits, characteristics, functions; ethnocentrism, acculturation, cultural lag, cultural diffusion, marginal man, ethos; social values – definition, values and norms, characteristics of values and its functions

UNIT II: Social Structure, Social Stratification and Migration

Structure of rural society – patterns of rural settlement, social institutions, social organizations,ecological entities (region, community, neighbourhood, family); social stratification – concept, functions, types, differences between class and caste system; migration – concept, factors influencing migration.

UNIT III: Social Control, Social Customs

Social control – definition; customs – conventions, folkways, mores, rituals, taboos; social interaction process – definition, basic social processes; social change – concept, factors influencing social change, indicators of social change; leader and leadership, definitions,types, functions, characteristics of a good leader, methods of selecting leaders

UNIT IV: Introduction to Educational Psychology, Intelligence, Teaching-LearningProcess

Education – psychology – educational psychology – social psychology – definitions, importance in extension; basic principles of human behaviour – sensation, attention, perception – meaning, characteristics; cognitive, affective, psychomotor domains; intelligence
– concept, types, measurement, factors affecting intelligence; personality – concept, types, measurement, factors influencing personality; teaching–learning process – teaching – definition, meaning, principles of teaching, steps in extension teaching; learning – definition, meaning, principles, types of learning, learning situation.

UNIT V: Motivation, Attitude

Motivation – concept, Maslow's hierarchy of needs, intrinsic and extrinsic motivation, techniques of motivation, importance in extension; attitude – concept, factors influencing the development of attitudes and current stream of thoughts.

Lesson Plan

Theory Schedule

1. Sociology and rural sociology – definitions, importance of rural sociology in extension education
2. Society – rural and urban, characteristics, differences and relationship, important characteristics of Indian rural society
2. Social groups – definitions, classification, role of social groups in extension
3. Culture – concept, cultural traits, characteristics, functions
4. Ethnocentrism, acculturation, cultural lag, cultural diffusion, marginal man, ethos
5. Social values – definition, values and norms, characteristics of values and its functions
6. Structure of rural society – patterns of rural settlement
7. Social institutions,
8. Social organizations
9. Ecological entities - region, community, neighbourhood and family
10. Social stratification – concept, functions, types, differences between class and castesystem
11. Migration – concept, factors influencing migration
12. Social control – definition; customs – conventions, folkways, mores, rituals, taboos
13. Social interaction process – definition, basic social processes

14. Social change – concept, theories, factors and indicators of social change

16. Leader and leadership - definitions, types, functions

17.Mid-semesterExamination

18. Characteristics of a good leader and methods of selecting leaders

19. Education – psychology – educational psychology –definitions, importance in extension

20. Social psychology – definitions, importance in extension21.

Basic principles of human behaviour

22.Sensation, attention, perception – meaning, characteristics

23.Cognitive, affective, psychomotor domains

24. Intelligence – concept, types, measurement, factors affecting intelligence25.

Personality – concept, types

26.Personality measurement- factors influencing personality

27.Teaching–learning Process

28.Teaching – definition, meaning, principles of teaching29.

Steps in extension teaching

30. Learning – definition, meaning, principles

31. Types of learning, learning situation

32.Motivation – concept, Maslow's hierarchy of needs , intrinsic and extrinsic motivation

33.Techniques of motivation, importance of motivation in extension

34. Attitude – concept, factors influencing the development of attitudes and current stream ofthoughts.

Course Outcome

At the end of the course students will be able to

CO 1: Understand basics concepts related to rural sociology and educational psychology.**CO 2:** Gain expertise on practical applications of sociological and psychological concepts.**CO 3:** Gain expertise on application of various psychological tests.

CO 4: Develop leadership skills

CO 5: Know the hierarchy of needs and techniques of motivation

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	0	0	3
CO2	0	2	0	0	3	0
CO3	0	0	2	0	0	0
CO4	0	1	0	3	0	0
CO5	1	0	0	0	0	3

References

1. Chatterjee, S. 2000. Advanced Educational Psychology, Books & Allied (P) Ltd., Calcutta.
2. Chauhan, S.S. 2001. Advanced Educational Psychology, Vikas Publishing House Pvt.Ltd., New Delhi.
3. Chitambar, J.B.1997. Introductory Rural Sociology, New Age International (P) Ltd.,Publishers, New Delhi.
4. Kundu, C.L and Tutoo, D.N. 2001. Educational Psychology, Sterling Publishers Pvt. Ltd.,New Delhi.
5. Vidya Bhushan and Sachdeva, D.R. 2003. An Introduction to Sociology, Kitab Mahal, Allahabad.

e-resources

1. https://agripathshala.com
2. https://www.hillagricc.ac.in
3. https://agrimoon.com
4. https://www.sapraonline.com

5. https://agrifair.in

23ENG - 101 COMPREHENSION AND COMMUNICATION SKILLS IN ENGLISH 2 (2+0)

Learning objectives

- To impart basic language skills such as listening, speaking, reading and writing in order to communicate with speakers of English Language
- To develop the linguistic competence necessarily required in various life situations
- To improve English pronunciation and enhance proficiency in English

Theory

Unit I: Comprehension

Reading Comprehension –Synonyms—Antonyms--Verbal Ability, A list of Words often confused and misused

Unit II: Vocabulary

Vocabulary --Homonyms --Homophones

Unit III: Grammar

Functional Grammar--Tenses --Active voice and Passive voice--Degrees of Comparison -- Types of Sentences--Direct and Indirect Speech --Agreement of Verb with Subject—Articles—Prepositions--Parts of Speech

Unit IV: Composition

Business Correspondence--Principles of Letter Writing--Structure and Layout of Letters -- Quotations and Orders --Tenders--Job Application Letters --Social Correspondence—CV-- Professional Writing--Precis Writing

Unit V: Interview

The Screening Interview--The informational Interview --The Stress Interview--The Behavioural Interview--The Audition --Body Language and Interview

Lesson plan

Theory Schedule

1. A Lesson: “The Sporting Spirit” --Answering the questions related to the text -- Comprehension pertaining to the Textual Grammar i.e., Fill in the blanks, Matching and vocabulary
2. Comprehension and answering the questions related to the Text
3. Synonyms, List of synonyms, Choose the correct synonyms, exercises – Practice and Implementation Antonyms, fill in the blanks, choose the correct Antonyms, exercisesPractice and Implementation
4. Verbal Ability, A list of Words often confused and misused – Practice and Implementation
5. Comprehension pertaining to the Textual Grammar i.e., Fill in the blanks, Matching, Vocabulary and Reading Comprehension
6. Reading Comprehension and answering the Questions
7. Homonyms -- Homonyms are distinct words with quite different meanings --Use the following words in two ways, more words at a glance and exercises related to GRE & TOEFL
8. Homophones, A list of homophones, Fill in the blanks, Underline the correct word and exercises related to GRE & TOEFL
9. A Lesson: “Spoken English and Broken English” by G.B. Shaw. Answering the questionsrelated to the Text. Fill in the blanks, Matching, Vocabulary and Reading Comprehension
10. Functional Grammar, Tenses, Active voice and Passive voice, Degrees of Comparisonand types of sentences
11. Direct and Indirect speech and Agreement of verb with subject

12. Functional Grammar, Articles, Prepositions, Parts of Speech and Agreement of Verb with Subject
13. Business Correspondence, Principles of Letter writing, Courtesy and Consideration, Directness and Conciseness, Avoid Verbosity and participial Endings, Clarity and Precision, Structure and layout of letters, Planning a letter, Quotations, Orders, Tenders, Sales letters, Claim and Adjustment Letters, Job application letters, Social correspondencePersonal Correspondence and CV
14. The Style**,** Importance of Professional Writing, Choice of words and Phrases, Clichés, Jargons, Foreign words and phrases
15. Precis Writing, Summarizing, The essential features of a good précis, Important points while making a précis, Make a précis of the following paragraph and suggest suitable title. Figurative language
16. Interview, The Screening Interview, The informational Interview, The Directive Style, The Meandering Style, The Stress Interview, The Behavioural Interview, The Audition, The Tag-Team Interview, The Mealtime Interview, The Follow-up Interview, Fermi Interview, Preparing for the Interview, Body Language and Interview, Types of Interviews Questions. Idiomatic language
17. **Mid Semester Examination**
18. Effective Listening – Developing Listening Skills – Honing Listening skills
19. Listening to Short talks and Lectures from the cassettes of EFLUniversity
20. Spoken English, Vowels, consonants, monophthongs, diphthongs, triphthongs
21. Stress, intonation, phonetic transcription
22. Seminars, Conferences, preparation and demonstration
23. Oral Presentation by students, Articulation and delivery – Evaluation sheet for oralpresentation
24. Communication skills – Verbal communication, Written Communication
25. Telephonic Conversation
26. Reading Skills, Skimming, Scanning, Extensive reading, Intensive reading examples
27. Meeting, purpose, procedure, participation, physical arrangements
28. Presentation of reports by using power point & L.C.D
29. Interviews – Mock interviews
30. Debate and Group discussion
31. Using a dictionary effectively
32. Vocabulary
33. Pronunciation Practice
34. **Final practical examination**

References

1. M.G, Nayar. *A Galaxy of English Essayists,* New Delhi, Trinity, 2021.
2. Krishna Mohan and Meera Banerji, *Developing Communication Skills*, New Delhi, Trinity,2021
3. Sharon J. Gerson and Steven M. Gerson, *Technical Writing,* New Delhi, Pearson, 2021.
4. Asraf Rizvi, *Effective Technical Communication,* New Delhi, Tata- McGraw Hill, 2021.
5. T. Sriraman, *College Prose,* Chennai, Macmillan, 2007.
6. Parvathi Vasudev, *Spring Blossoms*, Chennai, Anu Chitra, 1989.

23EXT 101* AGRICULTURAL HERITAGE (1+0)

Learning objectives

To enable the student to

- Understand the importance of Agricultural heritage
- Know about the value of Indigenous knowledge in agriculture
- Familiarize the students about current scenario of Indian Agriculture

Learning outcomes

- The students have gained the basic knowledge about agricultural history of India.
- They have been familiarized with the indigenous knowledge and present scenario of Indian agriculture.

Theory

Unit I:

Agricultural heritage - Introduction, definition of agricultural heritage- Need and importance of Agricultural heritage- Historical facts- Relevance of heritage to present day Agriculture

Unit II:

Development of human culture – stone age, bronze age and iron age periods; Ancientagricultural practices - Indus civilization, Vedic civilization- Agriculture and Kaudilya's Artha sasthra- Agriculture in Sangam literature, Agriculture in Tamil dynasties Chera, Chola, Pandyaans Pallavas

Unit III:

Journey of Indian agriculture and its development from past to modern era- Development of agriculture in World and India- Green revolution in India - Role of International/NationalInstitutions for Agricultural research

Unit IV:

Indigenous Traditional Knowledge (ITK): Plant production and Plant protection through Indigenous traditional knowledge- Crop voyage in India - Branches of Agriculture- Agricultural resources available in India.

Unit V:

Classifications of crops- Major crops of India and Tamil Nadu- National Agriculture setup in India- Current scenario of Indian agriculture- Indian Agricultural concerns and future prospects**Lesson plan**

Theory Schedule

1. Agricultural heritage; Definition, Indian agricultural heritage; Introduction
2. Need and importance of studying Agricultural heritage
3. Historical facts of agricultural heritage, relevance of heritage to present day Agriculture
4. Development of human culture – stone age, bronze age and iron age periods
5. Agriculture and allied activities in ancient India and Tamil Nadu- Indus civilization
6. Agriculture in Vedic civilization and Kaudilya's Artha sasthra
7. Agriculture in Sangam literature
8. Agriculture in Tamil dynasties Chera, Chola, Pandya and Pallavas
9. **Mid Semester Examination**
10. Journey of Indian agriculture and its development from past to modern era
11. Development of agriculture in World and India- Green revolution in India
12. Role of International/National Institutions for Agricultural research
13. Indigenous Traditional Knowledge (ITK): Plant production and Plant protection through Indigenous traditional knowledge
14. Crop voyage in India - Branches of Agriculture- Agricultural resources available in India
15. Classifications of crops- Major crops of India and Tamil Nadu
16. National Agriculture setup in India- Current scenario of Indian agriculture

17. Indian Agricultural concerns and future prospects

References

1. A text book on Agricultural heritage of India by D. Kumari M. Veeral
2. Ancient Indian heritage by Varahamihira'S 2nd volume.
3. History of Agriculture in India up to C 1200 a.d
4. Principles of Agronomy and Agricultural Heritage by ICAR
5. Nene, Y.L. and Choudhary, S.L. (2002). Agricultural heritage of India, Asian Agri. History foundation, Secundrabad

e- References

1. www.icar.res.in
2. www.webcast.gov.in
3. www.icar.org.in/nasm.html
4. www.eagri.org
5. www.epgp.inflibnet.ac.in

23NSS 111*/NCC 111* (0+1)

NSS 111 National service scheme*

Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skilful in executing democratic leadership, developing skill in programme development to be able for self employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

All the activities related to the National Service Scheme course is distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having one credit load. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least 60 hours of social work in different activities in a semester other than fiveregular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by allthe volunteers of NSS as per direction.

Theory

Semester I

Course Title: National Service Scheme I

Introduction and basic components of NSS:

Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health

NSS programmes and activities

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ 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 mobilisation

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership **Social harmonyand national integration** Indian history and culture, role of youth in nation building, conflictresolution and peacebuilding

*23TAM 101 தமிழ் இலக்கியம் - நவீனத்துவமும் இலக்கியச் சரித்திரமும் (0 + 1).**

சிறுகதை இலக்கியம் - நவீன முயற்சிகள் / புறநானூறு பாடல்களில் மனித உயிர் உணர்வுகள் - பழந்தமிழ் இலக்கியத்தில் தத்துவ நோக்கம் / சங்க இலக்கியத்தின் வெளிப்பாடு, உருவாக்கம், இலக்கியச் சிந்தனைகள்.
கவிதை வடிவங்கள்: புதுக்கவிதை, மரபுக் கவிதை
கட்டுரை வடிவங்களும் அவற்றின் வளர்ச்சியும்

பரிந்துரைகள்:

1. சிறுகதை இலக்கியம் - நவீன முயற்சிகள் / புறநானூறு பாடல்களில் மனித உயிர் உணர்வுகள் - பழந்தமிழ் இலக்கியத்தில் தத்துவ நோக்கம்.
2. தலைப்பு, அறிவியல் சரித்திரம் - (விளக்கம் / சிந்தனை).
3. கலை, புயல், பொருள் தரம், பண்பாட்டு மற்றும் மரபு சார்ந்த இலக்கியங்கள்.
4. கவிதை வடிவங்கள் / புதிய கவிதை வகைகள் - 20ஆம் நூற்றாண்டில் கவிதை வடிவங்கள் மற்றும் கருத்துக்கள்.
5. சிறுகதைகள் - நவீன தத்துவ ரீதியான தொகுப்பு.
6. சிந்தனை, வாழ்க்கை, பொருள் ஆராய்ச்சி.
7. தமிழ் இலக்கியத்தில் மனித உணர்வு வளர்ச்சிகள்.
8. அடிப்படையிலான அழகிய வடிவங்கள்.
9. படைப்பாளர் மற்றும் கருத்துகளின் அமைப்பு.
10. கவிதைகள், மொழி மற்றும் தத்துவங்கள் - மொழியில் உள்ள பொருள் பார்வை.
11. சிறுகதை இலக்கியம் - நவீன முயற்சிகள் - மனித மொழி வாழ்க்கை.
12. மத்தியதேச மொழி – கற்பனை பாணியில் இவற்றின் தொடர்புகள்.
13. கட்டுரைகளில் படிப்பினைகள் - வரலாற்றுச் சார்ந்த கருத்துக்கள்.
14. சமூக வாழ்க்கை - மனித எழுத்து இயக்கங்கள் – கலை, இலக்கியத் தத்துவங்கள் - தமிழ் இலக்கியத் தோற்றங்கள்.
15. நூற்றாண்டு இலக்கியம் - இலக்கியத்தை அணுகுதல், சமூகச் சிந்தனைகள்.
16. தலைப்புகள் - இலக்கிய வளர்ச்சி - 20ஆம் நூற்றாண்டின் தொடர்.
17. மனிதகுல பன்முகத்தன்மை - எளிய மொழியில் உணர்வுகளின் விளக்கம்.
18. தமிழக இலக்கியம் - பதிப்புருக்கள், கல்வி மற்றும் அறிஞர்களின் பார்வைகள்.
19. நூலாசிரியர்களின் விமர்சனங்கள், செயல்பாடுகள் மற்றும் வரலாற்று பதிவு.
20. அவற்றின் படைப்புகள் - பல்வேறு ஆராய்ச்சிகள், விளக்கங்களின் பிறப்புகள்.

21. "படம்", "செயல்பாடுகள்", "உலகவியல்" - இணைவுகள், இணைக்கப்பட்ட விவரங்கள்.

Volunteerism and shramdan Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan 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 rights to information

Family and society

Concept of family, community (PRIs and other community based organisations) and society

Semester II

Course Title: National Service Scheme II

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, inter personal communication

Youth development programmes

Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations

Health, hygiene and sanitation

Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes 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

Semester III

Course Title: National Service Scheme III

Vocational skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditionsand opportunities. Each volunteer will have the option to select two skill-areas out of this list **Issues related environment**

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management

Introduction and classification of disaster, rehabilitation and management after disaster; role ofNSS volunteers in disaster management.

Entrepreneurship development

Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role offinancial and support service institution.

Formulation of production oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

Collection and analysis of data, documentation and dissemination of project reports

Semester IV

Course Title: National Service Scheme IV

Youth and crime

Sociological and psychological factors influencing youth crime, cyber crime, pear mentoring in preventing crime and awareness for juvenile justice

Civil/self defence

Civil defence services, aims and objectives of civil defence; needs and training of self defence

Resource mobilisation

Writing a project proposal of self fund units (SFUs) and its establishment

Additional life skills

Positive thinking, self confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

Schedule

1. Introduction and basic components of NSS: Orientation
2. NSS programmes and activities
3. Understanding youth
4. Community mobilisation
5. Social harmony and national integration
6. Volunteerism and shramdan
7. Citizenship, constitution and human rights
8. Family and society
9. Importance and role of youth leadership
10. Life competencies
11. Youth development programmes
12. Health, hygiene and sanitation
13. Youth health, lifestyle, HIV AIDS and first aid
14. Youth and yoga
15. Vocational skill development
16. Issues related environment
17. Disaster management
18. Entrepreneurship development
19. Formulation of production oriented project
20. Documentation and data reporting
21. Resource mobilization
22. Additional life skills
23. Activities directed by the Central and State Government

23NCC 111 National Cadet Corps* (0+1)

Schedule

Semester I: National Cadet Corps

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march and dressing.
4. Saluting at the halt, getting on parade, dismissing and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, paceforward and to the rear.
6. Turning on the march and wheeling. Saluting on the march.
7. Marking time, forward march and halt.
8. Changing step, formation of squad and squad drill.
9. Command and control, organization, badges of rank, honours and awards
10. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.

Semester II: National Cadet Corps

11. Values and ethics, perception, communication, motivation, decision making, discipline andduties of good citizen.
12. Leadership traits, types of leadership. Character/personality development.
13. Civil defense organization, types of emergencies, fire fighting, protection,
14. Maintenance of essential services, disaster management, aid during developmentprojects.
15. 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.
16. Structure and function of human body, diet and exercise, hygiene and sanitation.
17. Preventable diseases including AIDS, safe blood donation, first aid, physical and mentalhealth.
18. Adventure activities
19. Basic principles of ecology, environmental conservation, pollution and its control.
20. Precaution and general behaviour of girl cadets, prevention of untoward incidents,vulnerable parts of the body, self defense.

Semester III: National Cadet Corps

1. Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and fallingout. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa.
3. Saluting at the shoulder at the halt and on the march. Short/long trail from the order andvice versa.
4. Guard mounting, guard of honour, Platoon/Coy Drill.
5. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
6. Loading, cocking and unloading. The lying position and holding.
7. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
8. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
9. Characteristics of Carbine and LMG.
10. Introduction to map, scales and conventional signs. Topographical forms and technicalterms.

Semester IV: National Cadet Corps

11. The grid system. Relief, contours and gradients. Cardinal points and finding north. Typesof bearings and use of service protractor.
12. Prismatic compass and its use. Setting a map, finding north and own position. Map toground and ground to map.
13. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
14. Field defenses obstacles, mines and mine lying. Bridging, waterman ship
15. Field water supplies, tracks and their construction.
16. Nuclear, Chemical and Biological Warfare (NCBW)
17. Judging distance. Description of ground and indication of landmarks.
18. Recognition and description of target. Observation and concealment. Field signals.Section formations.
19. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
20. Types of communication, media, latest trends and developments.

23PEY 111 Physical Education and Yoga Practices* 1(0+1)

Semester I: Physical Education and Yoga Practices

1. Teaching – Meaning, Scope and importance of Physical Education
2. Teaching – Definition, Type of Tournaments
3. Teaching – Physical Fitness and Health Education
4. Teaching of skills of Football/ Basket ball – demonstration, practice of the skills,correction, involvement in game situation (For girls teaching of Tennikoit)
5. Teaching of advance skills of Football/ Basket ball – involvement of all the skills in game situation with teaching of rules of the game
6. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
7. Teaching of skills of Ball Badminton/ Table Tennis – demonstration, practice of the skills, correction of skills, involvement in game situation
8. Mid Semester
9. Teaching of skills of Ball Badminton/ Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
10. Teaching of some of Asanas – demonstration, practice, correction and practice
11. Teaching of some of Asanas – demonstration, practice, correction and practice
12. Teaching of some of Asanas – demonstration, practice, correction and practice
13. Teaching of some more of Asanas – demonstration, practice, correction and practice
14. Teaching of some of Asanas – demonstration, practice, correction and practice
15. Teaching of some of Asanas – demonstration, practice, correction and practice
16. Construction and laying out of the track and field (*The girls will have Tennikoit and ThrowBall).

Semester II: Physical Education and Yoga Practices

17. Teaching of different asanas – demonstration practice and correction.
18. Teaching of different asanas – demonstration practice and correction.
19. Teaching of different asanas – demonstration practice and correction.
20. Teaching of different asanas – demonstration practice and correction.
21. Teaching of weight training – demonstration practice and correction.
22. Teaching of circuit training – demonstration practice and correction.
23. Teaching of calisthenics – demonstration practice and correction
24. Mid Semester
25. Teaching of skills of Hockey – demonstration practice of the skills and correction.
26. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.
27. Teaching of different track events – demonstration practice of the skills and correction.
28. Teaching of different track events – demonstration practice of the skills and correction.
29. Teaching of different track events – demonstration practice of the skills and correctionwith
30. competition among them.
31. Teaching of different field events – demonstration practice of the skills and correction.
32. Teaching of different field events – demonstration practice of the skills and correction.
33. Teaching of different field events – demonstration practice of the skills and correction with competition among them.

Note: 1) Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants) 2) The games mentioned in the practical may be inter changed depending on the season and facilities.

23MAT 101 ELEMENTARY MATHEMATICS** 2 (1+1)

Learning Objectives

To impart knowledge to the students on elementary mathematics topics required and useful inthe study of agricultural courses. By the end of the course, the students will be able to

- Understand concepts of geometry of straight lines, circles.
- Understand concepts on calculus and matrices and their applications.

Theory

Unit I: Straight Lines (7 hours)

Distance formula, section formula – Equation of co- ordinate axes, Equation of lines parallel to axes - Problems on distance between the lines, Change of axes - Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line - Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines- Angles between two st. lines, Parallel lines, Perpendicular lines..

Circles - Introduction to Circle, Equation of circle with centre and radius, General equation of acircle, Equation of circle passing through three given points and tangent of the circle - Simple problems.

Unit II: Differential Calculus (7 hours)

Definition of function, limit and continuity - Differentiation of x^n, e^x, sin x & cos x from first principle - Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions - Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method - Differentiation of Inverse Trigonometric functions .

Unit III: Partial Differentiation (6 hours)

Partial differentiation, homogeneous functions - Examples and problems on partial differentiation- Euler‘s theorem and its application.

Unit IV: Integral Calculus (6 hours)

Integration of simple functions - Integration of Product of two functions, Integration bysubstitution method - Simple problems.

Unit V: Matrices and Determinants (6 hours)

Definition of Matrices, Addition, Subtraction and Determinants of Matrices - Multiplication, Transpose of matrices - Properties of determinants up to 3rd order and their Evaluation - Simple problems.

Lesson plan

Theory Schedule

1. Straight lines: Distance formula, section formula (internal and external division).
2. Change of axes (only origin changed), Equation of co- ordinate axes, Equation of linesparallel to axes.
3. Problems on distance between the lines, Change of axes.
4. Slope-intercept form of equation of line, Slope-point form of equation of line, Two pointform of equation of line.
5. Intercept form of equation of line, Normal form of equation of line.
6. General form of equation of line, Point of intersection of two straight lines.
7. Angles between two straight lines, Parallel lines, Perpendicular lines.
8. Problems on Angles between two straight lines, Parallel lines, Perpendicular line.
9. Introduction to – Circle, Equation of circle with centre and radius, General equation of acircle, Equation of circle passing through three given points and tangent of the circle.
10. Differential Calculus: Definition of function, limit and continuity.
11. Problems on limits and continuity.
12. Simple problems on continuity, Differentiation of x^n, e^x, sin x & cos x from first principle.
13. Derivatives of sum, difference, product and quotient of two functions.
14. Differentiation of functions of functions.

15. Simple problems based on Derivatives of sum, difference, product and quotient of two functions.
16. Simple problems based on Differentiation of functions of functions.
17. Logarithmic differentiation, Differentiation by substitution method.
18. Simple problems based on Logarithmic differentiation and differentiation by substitution method.
19. Differentiation of Inverse Trigonometric functions.
20. Simple problems based on Differentiation of Inverse Trigonometric functions.
21. Partial differentiation, homogeneous functions.
22. Examples and problems on partial differentiation.
23. Euler's theorem and its application.
24. Integral Calculus: Integration of simple functions.
25. Integration of Product of two functions, Integration by substitution method.
26. Problems on Integration of Product of two functions.
27. Problems on Integration by substitution method.
28. Matrices and Determinants: Definition of Matrices, Addition, Subtraction.
29. Problems on Addition, Subtraction and Determinants of Matrices.
30. Multiplication, Transpose of matrices.
31. Problems on Multiplication, Transpose of matrices.
32. Properties of determinants up to 3rd order and their evaluation.

References

1. Analytical Geometry, T. K. Manickavachagom Pillay & Others, (Two & Three Dimensions) S. Viswanathan Printers & Publishers Pvt. Ltd. Chennai, 2004.
2. Calculus, S. Narayanan and T.K. Manickavachagom Pillay, (Volumes 1 and 2), S. Viswanathan Publishers, 1995.
3. Mathematical Foundations – P. R. Vittal, Margham Publications, Chennai, 2000.
4. Text Book of Matrix, A. K. Sharma, Discovery Publishing House 2004.
5. Essential Engineering Mathematics, Michael Batte, Ventus Publishing ApS (e-book).

23GPB 102 INTRODUCTORY BIOLOGY** (1+1)

Learning objectives

To expose the students to the basic features of crop plants and its classification, botanical description, economic parts and economic importance of different field and horticultural crops. **Theory**

Unit I: Systems of classification and general morphological description

Introduction to the living world, diversity and Characteristics of life, Origin of life, Evolution and Eugenics. Bentham and Hooker's classification of plant kingdom - Nomenclature and it guidelines - Agricultural classification of crops; General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf; Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.

Unit II: Botanical description and economic uses of Poaceae

List of cultivated crops, economic parts, chromosome number and family description ofPoaceae: Key botanical features of Rice, Wheat, sorghum, Maize, Pearl millet, Finger millet, list of small millets, Guinea grass, Napier grass, Cenchrus and Sugarcane.

Unit III: Botanical description and economic uses of Papilionaceae

List of cultivated crops, economic parts, chromosome number and family description of Papilionaceae: Key botanical features of Red gram, Bengal gram, Soybean, Black gram,

Green gram, Cowpea, Lablab, Horse gram, Groundnut, Lucerne, *Stylosanthes*, Clitoria, Agathi and Sunhemp.

Unit IV: Botanical description and economic uses of Pedaliaceae, BrassicaceaeandMalvaceae

List of cultivated crops, economic parts, chromosome number and family description of the following families and Key botanical features of the crops given against them: Brassicaceae - Rapeseed, Mustard and Cabbage, Cauliflower; Malvaceae: Cotton, Mesta and Bhendi.

Unit V: Botanical description and economic uses of following Horticultural crops

List of cultivated crops, economic parts, chromosome number and key botanical features ofthe crops and family description of the following families, Tiliaceae, Piperaceae, Chenopodiaceae, Solanaceae, Mimosae, Moraceae, Cucurbitaceae, Alliaceae, Musaceae,Rubiaceae, Theaceae, Medicinal Plants them.

Practicals

Family features - observation and description of habit, morphology of root, stem, leaves, inflorescence, flowers, floral diagram, floral formula and economic parts of Poaceae, Fabaceae, Brassicaceae. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides.

Lesson plan

Theory Schedule

1. Introduction to the living world, diversity and Characteristics of life, Origin of life, Evolution and Eugenics.
2. Bentham and Hooker's classification of plant kingdom - - International code of nomenclature and its major guidelines - author citation - Agricultural classification ofcrops.
3. General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leafshape, venation and phyllotaxy; Modification of roots and leaf.
4. Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.
5. List of cultivated crops, economic parts, chromosome number and family description of Poaceae; Key botanical features of Rice and Wheat.
6. Key botanical features of sorghum, maize, pearl millet and finger millet. List of small millets.
7. Key botanical features of Guinea grass, Napier grass, Cenchrus and sugarcane
8. List of cultivated crops, economic parts, chromosome number and family description of (Papilionaceae) Key botanical features of Red gram, Bengal gram and Soybean.
9. **Mid Semester Examination.**
10. Key botanical features of Black gram, Green gram, Cowpea, Lab lab, Horse gram and Groundnut.
11. Key botanical features of Lucerne, Stylosanthes, Clitoria, Agathi, and Sunnhemp.
12. List of cultivated crops, economic parts, chromosome number and family description of Brassicaceae Key botanical features of Rapeseed and Mustard, Cabbage, Cauliflower.
13. List of cultivated crops, economic parts, chromosome number and family description of Malvaceae; Key botanical features of Cotton, Mesta and Bhendi.
14. List of cultivated crops, economic parts, chromosome number and family description of Solanaceae, Mimosae and Moraceae.
15. Key botanical features of Tobacco, Potato, Chilli, Tomato and Brinjal, Desmanthes,Subabul and Mulberry.

16. List of cultivated crops, economic parts, chromosome number and family description of Cucurbitaceae and Alliaceae; Cucurbitaceae: Key botanical features of Cucumber, Pumpkin and Ashgourd; Alliaceae: Onion and Garlic.
17. List of cultivated crops, economic parts, chromosome number and family description of Musaceae, Rubiaceae and Theaceae; Key botanical features of Banana, Coffee and Tea.

Practical schedule

1. Observing general morphology of roots, stems and leaves.
2. Observing general morphology of inflorescence - flowers, stamens and pistils.
3. Family characters, Botany, Economic parts, floral diagram and floral formula of thefollowing crop plants: - Poaceae: Rice and Wheat.
4. Poaceae: Sorghum, Maize, Pearl millet and Finger millet.
5. Poaceae: Guinea grass, Napier grass, Cenchrus and Sugarcane.
6. Papilionaceae: Redgram, Bengal gram and Soybean.
7. Papilionaceae: Blackgram, Greengram, Cowpea, Lab - lab, Horse gram and Groundnut.
8. Papilionaceae: Lucerne, Stylosanthes, Clitoria, Agathi, Sunnhemp, and Sesbania.
9. Brassicaceae: Rapeseed and Mustard, Cabbage and Cauliflower.
10. Malvaceae: Cotton, Mesta and Bhendi.
11. Tiliaceae: Jute; Piperaceae: Betelvine; Chenopodiaceae: Sugar beet.
12. Solanaceae: Tobacco. Potato, Chilli, Tomato and Brinjal; Mimosae: Desmanthes andSubabul, Moraceae: Mulberry.
13. Cucurbitaceae: Cucumber, Pumpkin, Ashgourd; Alliaceae: Onion and Garlic.
14. Musaceae: Banana; Rubiaceae: Coffee; Theaceae: Tea.
15. Cell, tissues & cell division.
16. Internal structure of root, stem and leaf.
17. Study of specimens and slides.

IISemester

23AGR 102 INTRODUCTORY AGROMETEOROLOGY AND CLIMATE CHANGE (1+1)

Learning objectives

- To know the basic concepts of agricultural meteorology and recording various weather elements in observatory.
- To understand about solar radiation, temperature and relative humidity on cropproduction
- To be familiar with cyclones, El Nino and La -Nina
- To study of clouds, precipitation, drought, flood and evapotranspiration.
- To study about different Agro climatic zones of India and Tamil Nadu, importance of weather forecasting.

Theory

Unit -I: Introduction to Meteorology and Agrometerology

Introduction to meteorology – branches, importance in crop production, scope of atmosphere -lower and upper- composition and its characters. Agro climatic zones of India and Tamilnadu **Unit -II: Solar radiation, light and temperature**

Importance of solar radiation - sun and its thermal properties, different types of solar radiation and its effect on crop growth, lights and its influence on crop productivity, bandwidth, temperature, air and soil. Crop response to different conditions - factors affecting solar radiations, light and temperature.

Unit- III: Atmospheric pressure and wind

Atmospheric pressure - variation in atmospheric pressure, causes of variation, pressure and wind system of the world, wind, daily and seasonal variation of wind speed, cyclone, anti

cyclone. Effect of wind on crops - movement of air mountain and valley winds- land and sea breezes.

Unit -IV: Atmospheric humidity, precipitation and clouds

Atmospheric humidity-effect of humidity on crops- concept of saturation, vapour pressure and process of condensation, evaporation, evapotranspiration, PET, different forms of precipitationand condensation, cloud seeding (artificial rain making). Clouds- clouds formation, WMO classification and characteristics. Rainfall- importance of rainfall on crops, types of rain fall. Monsoon- definition, origin and distribution of South West Monsoon and North West Monsoon,mechanism and importance in Indian agriculture.

Unit -V: Climate change and weather forecasting

Various types of weather hazards influencing crop growth - modification of micro climate, climatic normal, livestock, and crops. Global warming- impact of El-nina. Weather forecasting -principles and types. Current stream of thoughts.

Practicals

Agromet observatory - site selection and layout. Acquiring skill in the use of different instruments and recording data on rainfall / precipitation temperature, pressure, humidity, winddirection and velocity, solar radiation, sunshine hours, evaporation, evapotranspiration, automatic weather station, preparation of synoptic charts and crop weather calendars, mapping of agro climatic zones.

Lesson plan

Theory Schedule

1. Introduction to meteorology – branches- definitions of meteorology, climatology andagricultural meteorology – scope and practical utility of agricultural meteorology.
2. Weather and climate- Factors affecting weather and climate-earth atmosphere- itscomposition, extent and structure
3. Atmospheric weather variable- agro climatic zones of India and Tamil Nadu
4. Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, long wave and thermal, terrestrial, net radiation and albedo.
5. Physiological responses of different bands of incident radiation – function of light, factors affecting distribution of solar radiation within the plant canopy, heat units.
6. Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, cardinal temperature- importance of air temperature-energy balance of earth.
7. Low and high air temperature plant injury- soil temperature- importance of soil temperature.
8. Atmospheric pressure – variation in atmospheric pressure- causes of variation- pressure and wind system of the world
9. **Mid-Semester Examination**
10. Wind, daily and seasonal variation of wind speed, cyclone, anti cyclone, effect of wind oncrops-movement of air and valley winds- land and seas breezes.
11. Atmospheric humidity, concept of saturation, vapor pressure, effect of humidity on crops.,concept of saturation, vapour pressure and process of condensation- evaporation –Evapotranspiration-PET
12. Precipitation and condensation – definition- different forms of precipitation andcondensation – cloud seeding (artificial rain making).
13. Clouds- clouds formation – WMO classification and characteristics.
14. Rainfall- importance of rainfall on crops- types of rain fall-monsoon definition – origin and distribution of South West Monsoon and North West Monsoon-mechanism and importancein Indian agriculture.

15. Weather hazards- drought , floods, frost, tropical cyclones , heat wave, cold wave, storms, hail storms, thunder storms, dust storms and tornadoes
16. Agricultural and weather relations, modifications of crop micro climate, climatic normal for crop and livestock production.
17. Weather forecasting, types of weather forecast and their uses-climate change, climatic variability, El-Nino and La-Nina, global warming, causes of climate change and its impact on national and global agriculture and Current stream of thoughts.

Practical Schedule

1. Visit to PRIST University Agrometeorology observatory and understanding varioustypes of agromet observatories.
2. Site selection & layout for observatory
3. Measurement of sunshine duration and light intensity
4. Measurement of maximum and minimum air temperature, its tabulation, trend andvariation analysis
5. Measurement of soil temperature
6. Determination of vapor pressure, relative humidity and dew point temperature readings, hygrometric table.
7. Measurement of atmospheric pressure with various equipments.
8. Measurement of wind speed, direction and preparation of wind rose.
9. Measurement of rainfall and its tabulation
10. Rainfall analysis
11. Measurement of evaporation and evapotranspiration
12. Measurement of dew - dew gauge
13. Weather forecasting, types and its importance in agriculture
14. Use of synoptic chart and weather reports
15. Climatic variability and analysis of its impact on agriculture
16. Mapping of agro climatic zones of India and Tamil Nadu and its characterization.
17. **Final practical examination**

Course Outcome

CO 1: To gain knowledge about role of weather elements in crop growth andhow to recordvarious weather elements

CO 2: To construct information about effect of solar radiation, temperature and relativehumidity on crop production

CO 3: To comprehend knowledge with cyclones, El Nina and La Nina

CO 4: To create awareness on cloud types, precipitation, drought, flood and evapotranspiration.

CO 5: To formulate cropping pattern for different Agro climatic zones of India and Tamil Nadu, importance of weather forecasting.

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	1	1	2
CO2	-	2	-	-	-	2
CO3	-	1	-	-	-	-
CO4	-	2	-	-	-	-
CO5	-	2	1	-	-	1

References

1. Bhardwaj. V. 2020. Climatic Change and Management of Weather for SustainableAgriculture. Agrotech Publishing Academy. Udaipur
2. Laxmi Lal. 2021. Introduction to Agrometeorology. Agrotech Publishing Academy. Udaipur.

3. Lenka D.2006. Climate Weather and Crops in India, Kalyani Publishers, Ludhiana.
4. Prasad Rao.G.S.L.H.V.2015. Agricultural Meteorology, Eastern Economy Edition (PH1) Learning Pvt Limited Publishers, Delhi.
5. Reddy.S.R.2014.Introduction to Agriculture and Agrometeorology, Kalyani Publishers,Ludhiana.

e-resources

1. http://eslamian.iut.ac.ir/sites/eslamian.iut.ac.ir/files/u125/agrometeoralogy.pdf
2. https://www.rvskvv.net/images/II-Year-II-Sem_Agro Meteorology_a_20.04.2020.pdf
3. https://agrifair.in/wp-content/uploads/2021/01/Introductory-Agrometeorology-and-Climate-Change.pdf
4. https://www.rvskvv.net/images/II-Year-II-Sem_Agro-Meteorology_a_20.04.2020.pdf.
5. https://drive.google.com/file/d/1C_KWCNCqOjzZ0Aqy_-kTbdjURHrkVOS8/view.

23AGR 103 IRRIGATION MANAGEMENT (1+1)

Learning objectives

- The students will study the basic principles and practices of irrigation.
- The students will gain clear scientific knowledge on soil water plant relationship
- The student will acquire knowledge about the water requirement for various field crops.
- The students will learn about various methods of irrigation and improve irrigation efficiency.
- The students will study and understand how to use poor quality water for irrigation and importance of drainage.

Theory

Unit I: Importance, history and role of irrigation water

Role of water in plants - importance of irrigation - water resources and irrigation potential of India and Tamil Nadu. History and development of irrigation in India – Irrigation systems of India and Tamil Nadu - Important major irrigation projects - Command area development and water management and water budgeting.

Unit II: Soil water availability and its measurement

Soil plant atmospheric continuum- physical properties of soil and classification of soil water- kinds of water in soil – soil moisture constants - effective root zone depth – moisture-extractionpattern – soil water movement - theories of soil water availability – measurement of soil moisture by direct and indirect methods – relative merits and demerits.

Unit III: Irrigation requirement and CWR

Potential evapotranspiration, reference crop evapotranspiration and consumptive use– Factors influencing water requirement - Crop co-efficient – crop co-efficient curve - Water requirement of crops – irrigation period and interval - critical stages of irrigation - water requirement and management of major field crops.

Unit IV: Irrigation scheduling, its methods and WUE

Scheduling of irrigation – different approaches -– IW/CPE ratio method –critical growth stages,Methods of irrigation –Surface and sub- surface irrigation - Water use efficiency (WUE) – factors influencing WUE - micro irrigation - sprinkler, drip irrigation method –Fertigation - advantages and disadvantages. fertigation scheduling in drip irrigation method.Recommended water soluble fertilizers.

Unit V: Irrigation water quality, its management and drainage

Irrigation management under limited water supply - quality of irrigation water – management practices for using poor quality water – saline, effluent and sewage water- SAR- Sodium adsorption ratio, sodicity hazard, residual sodium carbonate and boron toxicity - agricultural

drainage – surface and sub-surface drainage systems – relative merits and suitability to different soils-conjunctive use of surface and ground water and Current stream of thoughts.

Practicals

Estimation of soil moisture- Measurement of irrigation water through water measuring devices (flumes, weirs and water meter) - Measurement of field capacity, bulk density and infiltration rate. Calculation on irrigation Agronomy- Acquiring skill in land shaping for different surface irrigation methods - Operation and economics of drip and sprinkler irrigation systems - Estimation of crop water requirement - Scheduling of irrigation based on different approaches - Irrigation efficiency – Quality analysis of Irrigation water quality - On-farm irrigation structures - Visit to irrigation command area (Reservoirs and tanks) and water management institutes.

Lesson Plan

Theory Schedule

1. Irrigation–importance, definition and objectives. Water resources of India and Tamil Nadu–surface and ground water resources–Irrigation development–Important major irrigation projects.
2. Role of water in plant growth, command area development, water budget and management
3. Soil plant atmospheric continuum and soil-water relations-physical properties of soil – effective root zone depth–m o i s t u r e extraction pattern– moisture sensitive periods of important crops
4. Water retention in soil – adhesion and cohesion – soil moisture tension - pF - Soilmoisture characteristic curves -water movement in soils–infiltration–percolation–hydraulic conductivity–saturated and unsaturated waterflow
5. Kinds of water in soil–gravitational water-capillary water- hygroscopic water. soil moisture constants- saturation capacity - field capacity – permanent wilting point –available soil moisture – hygroscopic coefficient – theories of soil water availability –moisture retentive capacity viz., FC, PWP and ASM.
6. Measurement of soil moisture–Direct methods: gravimetric and volumetric method,i nfra - red moisture balance method, spirit burning method-Indirect methods: soil moisture probe, tensiometer, resistance blocks, pressure plate and pressure membrane apparatus– relative merits and demerits.
7. **Mid Semester Examination**
8. Evaporation, transpiration, ET and ET_o–factors influencing Evapotranspiration-daily, seasonal and peak period consumptive use.
9. Crop co-efficient–crop co-efficient curve-water requirement–irrigation requirement–net and gross irrigation requirement–irrigation interval–irrigation periods seasonal water requirement of important crops. critical stages of irrigation water requirements of major field crops
10. Scheduling of irrigation–different criteria- soil water regime approach-feel and appearance method, soil moisture tension and depletion of available soil moisture method - climatological approach, IW/CPE.
11. Plant indices approach–visual plant symptoms, soil-cum-sand mini plot technique, growthrate, relative water content, plant water potential, canopy temperature, indicator plants and critical growth stages
12. Surface irrigation methods–flooding, check basin, ring basin, border strip, furrow and corrugations–advantages and disadvantages.
13. Micro irrigation-sprinkler, drip irrigation method–definition-advantages and disadvantages-fertigation, scheduling in drip irrigation method –recommended water soluble fertilizers
14. Study of various weirs and flumes – water use efficiency (WUE)–crop water use and fieldwater use efficiency–factors influencing WUE.
15. Quality of water salinity hazard, SAR – Sodium adsorption ratio, sodicity hazard, residual sodium carbonate and boron toxicity-criteria and threshold limits– management practicesfor using poor quality water
16. Agricultural drainage–surface and sub-surface drainage systems–relative merits andsuitability to different soils.
17. Irrigation management under limited water supply and conjunctive use of surface and ground water. Current stream of thoughts.

Practical Schedule

1. Determination of bulk density
2. Determination of soil moisture content by gravimetric and volumetric methods
3. Installation and working of tensiometer in a cropped field
4. Installation and working of resistant block in a cropped field
5. Determination of field capacity by field method
6. Determination of permanent wilting point by field method
7. Measurement of irrigation water through flumes, weirs and water meters.
8. Scheduling of irrigation by IW/CPE ratio method
9. Measurement of plant water status using Pressure bomb apparatus/ porometer
10. Calculation of irrigation water needs (problems)
11. Determination of infiltration rate
12. Demonstration of surface methods of irrigation (basin, check basin and furrow)
13. Demonstration of drip irrigation system (filter cleaning, flushing of laterals) and calculation of crop water requirement.
14. Component, operation and maintenance of sprinkler irrigation system
15. Fertigation scheduling in important crops
16. Visit to farmer's field and Cost estimation of drip and sprinkler irrigation system
17. **Practical examination**

Course Outcome

CO 1: To understand basic principles and practices of irrigation. CO 2: To formulate ideas pertaining to soil water plant relationship.CO 3: To evaluate water requirement for various field crops.

CO 4: To gain skill development on layout of different methods of irrigation and ways toimprove irrigation efficiency.

CO 5: To analyses the quality of water for irrigation and formulate differentdrainage methods.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	-	2
CO2	3	2	-	-	-	
CO3	3	1	2	-	-	2
CO4	2	2	1	-	2	-
CO5	2	1	-	-	-	-

References

1. Dilip Kumar Majumdar. 2014. Irrigation Water Management-Principles andPractices. Prentice Hall India Learning pvt. Ltd., New Delhi
2. Lenka D. 2005. Irrigation and Drainage. Kalyani publishers, New Delhi.
3. Michael, A.M. 2009. Irrigation: Theory and Practice. Vikas publishing house pvt. Ltd., NewDelhi
4. Mukund Joshi and Prabhakara Setty, T.K. 2013. A Text Book of Irrigation and Water Management. Kalyani publishers, New Delhi.
5. Reddy S.R and Reddy, G.K. 2016. Irrigation Agronomy. Kalyani publishers, New Delhi

e-resources

1. http://drive.google.com/file/d/1ibm-R0CKwoNHuWUna0TknQN_tCVN/view?usp=sharing
2. http://nsdl.niscair.res.in/123456789/554Conceptsofrainfedagriculture–Formatted.pdf
3. https://imp.center/agri/amp/devices-used-for-measuring-ittigation-water/
4. http://nsdl.niscair.res.in/123456789/552-IRRIGATIONMETHODS - formatted.pdf
5. http://nsdl.niscair.res.in/123456789/495-correctedwatermanagement.pdf
6. http://nsdl.niscair.res.in/123456789/549IrrigationWaterResources-Formatted.pdf.

23ENT101 Fundamentals of Entomology (2+1)

Learning Objectives:

- To study about the relative position of insects in animal kingdom
- To explore the external morphology of insects
- To observe the anatomy, physiology and behaviour of insects
- To understand the classification of insects and to identify different groups of insects
- To study different methods of collection and preservation of insects

Theory

Unit–I: History and Importance

Entomology as a science – branches of Entomology – History of Entomology in India – Scope of Entomology. Origin of insects – Position of insects in the animal kingdom – Classification and Characters of Phylum Arthropoda. Relationship of Class Insecta with other Classes of Arthropoda. Reasons for insect dominance.

Unit–II: Morphology and Behaviour

Body segmentation, Structure and functions of insect cuticle – cuticular appendages and moulting. Basic Structures of head, thorax, abdomen and their appendages. Modifications of insect antennae, mouth parts, legs, wings, wing venation, wing coupling apparatus and abdomen and its appendages; Metamorphosis and their types; Insect behaviour – tropisms, biocommunication, rhythm, diapause, migration, defense and offence.

Unit–III: Anatomy and Physiology

Anatomy and functions of digestive, excretory, respiratory, circulatory, nervous andreproductive systems in insects. Types of reproduction and mating. Functions of exocrine and endocrine glands. Sensory organs and their functions.

Unit–IV: Taxonomy of Entognatha and Ectognatha (Insecta) (Apterygota and Pterygota)

Taxonomy, systematics and nomenclature – Classification of insects – Orders and examples. Distinguishing characters of agriculturally important non insect orders – Collembola, Proturaand Diplura and Insect orders Archaeognatha and Zygentoma. Paleoptera – Ephemeropteraand Odonata. Neoptera – Polyneoptera – Plecoptera, Dermaptera, Embioptera, Zoraptera,Orthoptera, Phasmatodea, Grylloblattodea and Mantophasmatodea, Mantodea, Blattodea(Cockroach), Blattodea (Termites), Paraneoptera – Psocodea (free living), Psocodea(parasitic), Thysanoptera and Hemiptera (Tingidae, Reduviidae, Miridae, Pentatomidae,Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belostomatidae, Gerridae, Cimicidae, Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae,Coccidae, Diaspididae, Pseudococcidae, Kerridae, Lophopidae and Psyllidae).

Unit V: Taxonomy of Endopterygota

Distinguishing characters of agriculturally important orders of Endopterygota - Neuroptera (Chrysopidae, Myrmeleontidae, Mantispidae, Ascalaphidae), Megaloptera, Rhaphidioptera,Coleoptera (Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Lampyriidae, Hydrophilidae, Scarabaeidae, Dynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae), Strepsiptera, Diptera (Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Pipunculidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae, Drosophilidae), Mecoptera, Siphonaptera, Trichoptera, Lepidoptera (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae, Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperiidae) and Hymenoptera (Tenthredinidae,Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygastridae, Bethylidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae). Current stream of development in Morphology,Physiology and Taxonomy

Practical

Observations on segmentation and external features of Grasshopper/Cockroach/Blisterbeetle. Methods of collection and preservation of insects including immature stages.Observations on structure and various types of insect head orientation, antennae, mouthparts,legs, wings, wing venation, wing coupling apparatus and abdominal appendages. Studies onmetamorphosis in insects and their immature stages. Demonstration and observation ofdigestive system and male and female reproductive systems in grasshopper/ cockroach.Observing the characters of agriculturally important orders and their families – Paleoptera -Ephemeroptera and Odonata. Neoptera – Polyneoptera – Plecoptera, Dermaptera,Embioptera, Orthoptera, Phasmatodea, Mantodea, Blattodea (Cockroach), Blatttodea (Termites) Paraneoptera – Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera. Endopterygotes – Neuroptera, Megaloptera, Rhaphidioptera, Coleoptera, Strepsiptera, Diptera, Mecoptera, Siphonaptera, Trichoptera, Lepidoptera and Hymenoptera.

Assignment: Each student has to submit 25 insects covering at least ten orders

Lesson Plan

Theory Schedule

1. Entomology- definition & Branches - Scope of Entomology - History of Entomology in India – Arthropoda – mention of insects in scripts – contributions of Fabricius, Caroleus Linnaeus, Rothney, L De Niceville, H.M Lefroy, T.B.Fletcher, T.V. Ramakrishna Ayyar, B.V.David, Ronald Ross, H.S. Pruthi, M.R.G.K. Nair and S.Pradhan; Locations and year of establishment of Zoological Survey of India (ZSI), Directorate of Plant Protection, Quarantine and Storage (DPPQS), Indian Institute of Natural Resins and Gums (IINRG), National Bureau of Agricultural Insect Resources (NBAIR), National Institute of PlantHealth Management (NIPHM), National Centre for Integrated Pest Management (NCIPM) and Forest Research Institute (FRI).
2. Origin of insects – Position of insects in the animal kingdom. Classification and Characters of Phylum Arthropoda – different Classes of Arthropoda and comparison of characters of Class Insecta with Arachnida, Crustacea, Symphyla, Chilopoda, Diplopoda and Onychophora
3. Major points related to dominance of Insects in Animal kingdom
4. Morphology - Structure and functions of body wall – different layers, chemical composition, functions
5. Cuticular appendages – cuticular processes and cuticular invaginations – chaetotaxy – moulting – apolysis, ecdysis and sclerotization
6. Body segmentation – Structure of head – procephalon and gnathocephalon, types of head, sclerites and sutures of insect head; Thorax and abdomen segments and appendages, Epimorphic and anamorphic development in insects
7. Structure of typical insect antenna and its modifications
8. Mouth parts - biting and chewing type, sucking type-piercing and sucking, rasping and sucking, chewing and lapping, sponging and siphoning, mask and degenerate types with examples
9. Structure of a typical insect leg, wing and its modifications – Structure of a typical insect wing and its modifications,Wing venationand wing coupling
10. Structure of insect abdomen and its modifications – Abdominal appendages, Structure of male and female genitalia.
11. Metamorphosis- No metamorphosis, hemi- and holo metamorphosis, intermediate and hyper metamorphosis and diapause – obligate and facultative diapause in insects.
12. Types of eggs, larvae and pupae
13. Insect behaviour – tropisms, biocommunication, rhythm, diapause, migration, defense andoffence.
14. Structure and functions of Digestive system – alimentary canal – structure of foregut, midgut and hindgut – histology, functions, filter chamber and peritrophic membrane – process of digestion
15. Excretory system – structure, functions and modifications of malpighian tubules – structure and functions of other organs of excretion
16. Respiratory system – tracheal system – structure of spiracle and trachea – classification based on

functional spiracles and other means of respiration

17. Circulatory system – open and closed types – organs of circulatory system – dorsal blood vessel (diaphragms, sinuses and accessory pulsatile organs) – process of circulation – properties and functions of haemolymph
18. **Mid Semester Examination**
19. Nervous system – neuron and its types (based on structure and function) – synapse, ganglia, central nervous system, sympathetic nervous system and peripheral nervous system
20. Reproductive system – structure of male and female reproductive systems – structure andtypes of ovarioles and structure of follicle, Types of reproduction in insects
21. Endocrine and Exocrine systems – their structure and functions
22. Sense organs – compound eyes – structure of ommatidium – ocelli – dorsal ocelli and lateral ocelli – types of images and auditory organs (tympanum and Jhonston‘s organ)
23. Taxonomy and systematics – importance - history – Binomial nomenclature –definitions ofbiotype, holotype, allotype and paratype – suffixes of tribes, subfamily, family and superfamily – law of priority – synonyms and homonyms - Species - subspecies – genus -family and order
24. Characters of Class Insecta – Ectognata and entognatha- orders under each group with characters
25. Classification of insects – Apterygota, Pterygota, Endopterygota with examples
26. Distinguishing characters of orders Collembola, Protura, Diplura, Archaeognatha andZygentoma
27. Distinguishing characters of Paleoptera orders– Ephemeroptera and Odonata.
28. Distinguishing characters of Neoptera orders – Polyneoptera – Plecoptera, Dermaptera, Embioptera, Zoraptera, Orthoptera
29. Distinguishing characters of orders Phasmatodea, Grylloblattodea and Mantophasmatodea, (Mantodea, Blattodea (Cockroach), Blattodea (Termites)
30. Distinguishing characters of Paraneoptera orders – Psocodea (free living), Psocodea (parasitic), Thysanoptera and Hemiptera
31. Distinguishing characters of order Endopterygotes – Neuroptera, Megaloptera, Rhaphidioptera, Coleoptera and families of agricultural importance
32. Distinguishing characters of order Strepsiptera, Mecoptera, Siphonaptera, Trichopteraand Diptera and their families of agricultural importance
33. Distinguishing characters of order Lepidoptera and families of agricultural importance
34. Distinguishing characters of order Hymenoptera and families of agricultural importance

Practical Schedule

1. Observations on segmentation and external features of grasshopper/ cockroach/blisterbeetle
2. Practicing the methods of collection, killing, pinning, labelling, display and preservation ofinsects including immature stages. Preparation of riker mount.
3. Observations on various types of insect head orientation and antennae
4. Demonstration of mouth parts of cockroach and plant bug and study of mouth parts offemale mosquito, honeybee, thrips, antlion grub, house fly and butterfly
5. Observations on the modifications in legs and wings (wing venation, regions, angles andwing coupling)
6. Observations on various types of abdominal appendages
7. Studies on the types of metamorphosis. Observations on immature stages of insects – Eggs, larvae and pupae and their types
8. Demonstration of digestive system and male and female reproductive systems (grasshopper/cockroach)
9. Observation on distinguishing characters of Ephemeroptera and Odonata. Plecoptera, Dermaptera, Embioptera and Orthoptera (Acrididae, Tettiigonidae, Gryllidae and Gryllotalpidae)
10. Observation on distinguishing characters of Phasmatodea, Mantodea, Blattodea (Cockroach), Blattodea (Termites) Psocodea – free living, Psocodea (parasitic) and Thysanoptera
11. Observation on distinguishing characters of Hemiptera (Families: Reduviidae, Pentatomidae,

Miridae, Coreidae, Pyrrhocoridae, Lygaeidae, Nepidae, Belastomatidae, Gerridae, Cimicidae, Tingidae, Cicadidae, Cicadellidae, Delphacidae, Aphididae, Cercopidae, Membracidae, Aleyrodidae, Coccidae, Diaspididae, Pseudococcidae, Kerridae, Lophopidae and Psyllidae)

12. Observation on distinguishing characters of Neuroptera, Megaloptera and Rhaphidioptera
13. Observation on distinguishing characters of Coleoptera (Families: Cicindellidae, Carabidae, Dytiscidae, Curculionidae, Apionidae, Staphylinidae, Coccinellidae, Gyrinidae, Lampyriidae, Hydrophilidae, ScarabaeidaeDynastidae, Cerambycidae, Melolonthidae, Anobiidae, Tenebrionidae, Bruchidae, Meloidae, Cetonidae, Buprestidae, Elateridae and Bostrychidae)
14. Observation on distinguishing characters of Strepsiptera, Mecoptera, Siphonaptera, Trichoptera, Diptera (Families: Cecidomyiidae, Agromyzidae, Tephritidae, Asilidae, Tabanidae, Tachinidae, Pipunculidae, Drosophilidae, Hippoboscidae, Culicidae, Syrphidae and Muscidae)
15. Observation on distinguishing characters of Lepidoptera (Families: Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Crambidae, Pyraustidae, Noctuidae, Arctiidae,Bombycidae, Cochlidiidae, Geometridae, Gelechiidae, Pterophoridae, Saturniidae, Sphingidae, Lymantriidae, Metarbelidae and Hesperiidae)
16. Observation on distinguishing characters of Hymenoptera (Families: Tenthredinidae, Apidae, Xylocopidae, Megachilidae, Bombidae, Sphecidae, Vespidae, Formicidae, Ichneumonidae, Braconidae, Platygastridae, Bethylidae, Evaniidae, Chalcididae, Encyrtidae, Eulophidae and Trichogrammatidae)
17. Orientation for final practical examination

Course Outcome:

CO1: Describe characters of Arthropoda and Insecta, and their relationship and reasons forinsect dominance

CO2: Explain morphology of insects, their appendages, their modifications, growth and development (metamorphosis) and behavior

CO3: Describe anatomy and physiology of various systems of insects

CO4: Identify different orders of insects based on their diagnostic characters up to familylevel

CO5: Demonstrate different collection and preservation techniques of insects

CO-PO Mapping Matrix:

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	0	0	1	0
CO2	1	2	0	0	1	0
CO3	3	3	0	0	1	0
CO4	2	3	0	0	1	0
CO5	3	3	0	0	1	0

References

1. Awasthi, V.B. 2007. *Introduction to General and Applied Entomology* (II edition), Scientific Publishers, Jodhpur. 394p.
2. Norman F. Johnson, Charles A. Triple Horn. 2004. *Borror and Delong's Introduction to theStudy of Insects* (VII Edition). Thomson Publication, New York. 888p.
3. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*, Vol. Iand II. Chapman and Hall Publication, London. 692p.
4. Gullen, P.J. and P.S. Cranston. 2011. *The Insects – An Outline of Entomology* (IV Edition).Wiley-Blackwell. UK. 565p.
5. Selvanarayanan, V. and S. Arivudainambi. 2018. *Introductory Entomology*. UnicornPublishers, Chennai. 262p.

e-Resources

1. http://www.itis.usda.gov/it is/
2. www.zin.ru/animalia

3. https://courses.cit.cornell.edu/ent201/content/*anatomy*2.pdf
4. www.*insects*explained.com/03*external*.htm
5. www.earthlife.net/*insects*/anatomy.html

23BIO - 101 FUNDAMENTALS OF PLANT BIOCHEMISTRY AND BIOTECHNOLOGY (1+1)

Learning objectives

- To understand the concepts of biochemistry and biotechnology
- To understand the biochemical reactions occurring in living cells
- To differentiate between qualitative identification and quantitative estimations
- To understand the separation of biomolecules using various biochemical techniques
- To understand the basic techniques of biotechnology

Theory

Unit I: Carbohydrates, lipids and proteins

Introduction – pH and Buffer – Phosphate and carbonate-bicarbonate buffer, Carbohydrate: Importance and classification. Structures of Monosaccharides, Structure of Disaccharides and Polysaccharides, Lipid: classification, Proteins: – amino acids – classification essential and non-essential amino acids, classification based on their hydrophobicity of R(side chain) groups.

Unit II: Nucleic acids

Nucleic acids – structure of nitrogen bases – nucleosides and nucleotides – Adenosinetriphosphate (ATP), Guanosine triphosphate (GTP), Cytidine triphosphate (CTP), Thymidine triphosphate (TTP) and Uridine triphosphate (UTP), Types of DNA -A, B & Z DNA. Types of RNA

Unit III: Enzymes and metabolism

Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Glycolysis and Tricarboxylic Acid (TCA) cycle- metabolic energy generation in the above cycles. Oxidative phosphorylation and substrate level phosphorylation – electron transport chain in mitochondria

Unit IV: Plant Biotechnology-I

Concepts and applications of plant biotechnology: Organ culture, embryo culture, cell suspension culture, callus culture, anther culture and pollen culture and their applications, Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance, cryo-preservation.

Unit V: Plant Biotechnology-II

Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and *Agrobacterium* mediated gene transfer methods, DNA fingerprinting. Biotechnology regulations

Lesson plan

Theory Schedule

1. Introduction – pH and Buffer – Phosphate and carbonate-bicarbonate buffer
2. Carbohydrate: Classification. Structures of Monosaccharides, Structure of Disaccharidesand Polysaccharides
3. Lipid: Classification
4. Proteins: – amino acids – classification essential and non essential amino acids – classification based on their hydrophobicity of R (side chain) groups.
5. Nucleic acids –Structure of nitrogen bases – nucleosides and nucleotides – Adenosine triphosphate (ATP), Guanosine triphosphate (GTP), Cytidine triphosphate (CTP),Thymidine triphosphate (TTP) and Uridine triphosphate (UTP)
6. Types of DNA -A, B & Z DNA. Types of RNA
7. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes.
8. Glycolysis and Tricarboxylic Acid (TCA) cycle- metabolic energy generation in the above cycles
9. **Mid Semester Examination**
10. Oxidative phosphorylation and substrate level phosphorylation – electron transport chainin mitochondria
11. Concepts and applications of plant biotechnology: Organ culture, embryo culture, cell

suspension culture.
12. Callus culture, anther culture and pollen culture and their applications
13. Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds andtheir significance
14. Cryo-preservation
15. Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods,
16. DNA fingerprinting
17. Biotechnology regulations

Practical schedule

1. Preparation of solution
2. Preparation of buffers and pH
3. Qualitative tests of amino acids
4. Quantitative estimation of glucose
5. Quantitative estimation of proteins
6. Titration methods for estimation of amino acids
7. Titration methods for estimation of lipids
8. Effect of pH on enzyme activity
9. Effect of temperature on enzyme activity
10. Substrate concentration on enzyme activity
11. Separation of amino acids and by Paper chromatography
12. Agarose gel electrophoresis-demonstration
13. Sterilization techniques. Composition of various tissue culture media
14. Preparation of stock solutions for MS nutrient medium.
15. Demonstration on isolation of DNA
16. Demonstration of paper electrophoresis techniques
17. **Practical Examination**

References

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2002.Biochemistry andMolecular Biology of Plants. John Wiley and Sons, UK.
2. Conn, E.E., Stumpf, P.K., Bruening, G. and Doi, R.H. 1995. Outlines of Biochemistry. John Wiley and Sons Inc., Singapore.
3. Lehninger, A.L., Nelson, D.A. and Cox, M.M. 2005. Principles of Biochemistry.CBS Publishers and Distributors, New Delhi.
4. H.S. Chawla (2003), Introduction to plant biotechnology Oxford & IBH Publishing Co. NewDelhi
5. B.D. Singh, (2006), Plant Biotechnology. Kalyani Publishers.
6. K.S.Bilgrami and A.K.Pandey (1992) Introduction to Biotechnology CBS Pub. New Delhi
7. P.K.Gupta (1994) Elements of Biotechnology Rastogi and Co., Educational Publishers,
8. Meerut Stryer, L. 2005. Biochemistry. W.H. Freeman and Company, New York.

23 GPB 102 FUNDAMENTALS OF GENETICS (2+1)

Learning objectives

- To inculcate knowledge on the fundamental concepts of inheritance and variation
- To make the students to understand the Structure of chromosomes and their functions
- To explore linkage and crossing over techniques for drawing gene maps
- To understand the sex determination process and inheritance of quantitative traits.
- To decipher the genetic code for the determination of protein product.

Theory

Unit I; Mendal's work and non-mendalian inheritance

Pre-Mendelian ideas about heredity – Vapor and fluid theory, Magnetic power theory, Preformation theory, Lamarck's theory, Darwin's theory, Germplasm theory and Mutationtheory. Post mendalian

concepts- Probability and Chi-square- Mendel's experiments and laws of inheritance. Allelic interactions – Dominance vs. recessive, complete dominance, codominance, incomplete dominance, over dominance. Deviation from Mendelian inheritance
– Non allelic interaction without modification in Mendelian ratio – Bateson and Punnett's experiment on fowl comb shape. Non allelic interaction with modification in Mendelian ratio –i.) Dominant epistasis (12:3:1) ii.) Recessive epistasis (9:3:4) iii.) Duplicate and additiveepistasis (9:6:1) iv.) Duplicate dominant epistasis (15:1) v) Duplicate recessive epistasis (9:7) vi.) Dominant and recessive epistasis (13:3); Lethal genes, Pleiotropy, penetrance and expressivity, phenocopy: Multiple alleles, blood group in humans, coat colour in rabbits, self incompatibility in plants; pseudo alleles, isoalleles.

Unit II; Study of chromosomes and chromosomal theory of inheritance

Structure and function of cell and cell organelles - Chromosome structure, chemical composition, nucleosome, centromere, telomere, euchromatin, heterochromatin, NOR, satellite chromosome, karyotype, ideogram –Types of chromosomes based on position of centromere, based on structure and function: based on the role in sex determination, normal and special chromosomes - polytene, lamp brush, other types of chromosomes - B, ring and isochromosomes. Cell division – mitosis, meiosis and their significance, cell cycle-Chromosomal theory of inheritance.

Unit III; Recombination genetics and chromosomal aberrations

Linkage - coupling and repulsion; Experiment on Bateson and Punnet Chromosomal theory of linkage of Morgan – Complete and incomplete linkage, Linkage group. Crossing over –significance of crossing over; cytological proof for crossing over - Stern's experiment; Factors controlling crossing over. Strength of linkage and recombination; Two point and three-pointtest cross. Double cross over, interference and coincidence; genetic map. Chromosomalaberration: Variation in chromosome structure – deletion, duplication, inversion andtranslocation – genetic and cytological implications; Chromosomal aberration: Variation in chromosome number – euploid, aneuploid, types of aneuploids and their origin; Uses of Di haploids and Doubled haploids in Genetics-Nondisjunction - Klinefelter syndrome and Turner syndrome; Polyploid - auto and allopolyploids, their characters; evolution of wheat, Triticale, cotton, tobacco, Brassicas.

Unit IV; Sex chromosomes and extra chromosomal inheritance

Sexual reproduction- Sporogenesis and Gametogenesis- Sex determination: Autosomes and sex chromosomes - chromosomal theory of sex determination - different types –Genic balancetheory of Bridges, Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex-limited inheritance. Cytoplasmic inheritance andmaternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis jalapa* - iojap gene of maize, cytoplasmic male sterility in rice, kappaparticles of paramecium - plasmid and episomic inheritance. Quantitative inheritance – Multiple factor hypothesis – Nilsson Ehle experiment on wheat kernel colour. Polygenes – transgressive segregation, comparison of quantitatively and qualitatively inherited characters; modifiers; Types of gene action controlling quantitative traits. Mutation – characteristics of mutation – Classification of Mutation- micro and macro mutation – ClB technique - molecular basis of mutation- Transition and transversion; major physical and chemical mutagens.

Unit V DNA-Models, Replication , Genetic code and Protein Synthesis

Nature of Genetic material- DNA as genetic material – Griffith's experiment, experiment of Avery, McCleod and McCarthy – confirmation by Hershey and Chase; RNA as genetic material
– Frankel, Conrat and Singer experiment. Structure of DNA – Watson and Crick model –Central dogma of life. Proof for semi conservative method of DNA replication; Models of DNA replication;
RNA types - mRNA, tRNA, rRNA; Genetic code, protein synthesis; Gene function-Regulation of gene expression – operon model of Jacob and Monad; Gene concept- Cistron,muton and recon;
Complementation test; exons, introns – split genes –Functional genomics,Metagenomics,
Transcriptomics, Proteomics, Metabolomics and Phenomics.

Practicals

Lesson plan

Theory lecture schedule

1. Pre Mendelian concepts and Post Mendelian concepts of heredity
2. Mendelian principles of heredity. Law of segregation and Law of independent assortment
3. Exceptions to Mendel ‘s 1st law. Dominance relationships
4. Exceptions to Mendel ‘s 2nd law. (Law of incomplete dominance and interaction of factors)
5. Epistatic gene interactions (3 interactions with examples)
6. Epistatic gene interactions
7. Cell organelles
8. Chromosome –structure, types
9. Special chromosomes
10. Chromosomal theory of Inheritance
11. Cell division, cell cycle, mitosis
12. Meiosis
13. Probability and chi-square
14. Multiple alleles examples
15. Blood group genetics, pleiotropism and pseudo alleles
16. Sex determination mechanisms
17. **Mid semester examination**
18. Sexual reproduction-sporogenesis and Gametogenesis
19. Sex determination mechanisms
20. Sex linkage, sex limited and sex influenced traits
21. Linkage – its estimation, two-point test cross
22. Crossing over mechanisms, Three-point test cross, chromosome mapping
23. Structural changes in chromosomes Deletions, Duplications and inversions
24. Translocations, examples of all structural alternations
25. Mutations and classifications
26. Mutagenic agents, methods of inducing mutations, CLB techniques
27. Qualitative and quantitative traits
28. Polygenes, continuous variations, multiple factor hypothesis
29. Cytoplasmic inheritance
30. Nature and structure of DNA, RNA
31. Replication of genetic material, DNA and RNA
32. Protein synthesis, transcription
33. Translational mechanisms of genetic material gene concept, gene structure
34. Gene function and regulation. Lac operon and top operator Genetic disorders

Practical schedule

1. Study of microscope. Study of cell structure
2. Study of cell organelles
3. Experiments on monohybrid
4. Experiments on Dihybrid
5. Experiments on trihybrid
6. Test cross, backcross, experiments on gene interactions (monohybrid)
7. Experiments on Study of cell gene interactions (Di hybrid)
8. Experiments on epistatic gene interactions
9. Experiments on epistatic gene interactions 1
10. Experiments on probability

11. Experiments on chi-square test
12. Experiments on chi-square test –Gene interactions
13. Determination of linkage and cross over analysis through two-point test cross data
14. Determination of linkage and cross over analysis through three-point test cross data
15. Sex linked inheritance in *Drosophilla*
16. Study of models on DNA and RNA structure
17. **Final practical examination**

Course Outcome

CO 1: Students will understand the molecular structure of DNA and the central dogma oflife.
CO 2: Importance of studying Linkage and recombination mapping will be well understood bythe students.
CO 3: Students will able to figure out the Fine structure of gene and gene mappingtechniques.
CO 4: The necessity of studying Gene regulation and function will be well elucidated
CO 5: To explore the students in understanding various Genetic disorders and have a betteridea on consanguineous mating

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	**3**				
CO2		**1**	**2**		
CO3				**2**	
CO4					**4**
CO5					

References

1. B.D. Singh. Fundamental of Genetics. Kalyani. India
2. Gardner E J, Simmons M J & Snustard D P. Principles of Genetics (VIII Edn). John Wiley& Sons, New York.
3. Gupta, P.K. 1985.Cytology, genetics and cytogenetics. Rastogi Publication, India.
4. Khanna VK. Genetics–Numerical Problems. Kalyani Publishers, New Delhi.
5. Phundan Singh. Elements of Genetics. Kalyani publishers, New Delhi.

e-resources

1. http://ecourses.iasri.res.in/
2. https://biologywala.com/genetics-a-conceptual-approach-pdf-book-reference-books-of-genetics-free-download/#1_Genetics_a_conceptual_approach
3. https://biologywala.com/genetics-a-conceptual-approach-pdf-book-reference-books-of-genetics-free-download/#2_Principle_of_genetics_pdf_book
4. https://www.nature.com/scitable/ebooks/essentials-of-cell-biology-14749010/
5. https://www.nature.com/scitable/ebooks/essentials-of-genetics-8/

23SOL 102 MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT (2+1)

Learning objectives

- To gain knowledge on plant nutrients and basic principles of soil fertility.
- To important knowledge on soil fertility evaluation
- To learn about types of commercial fertilizers and its effect on soil and crop
- To understand the importance of organic manures for sustainable agriculture.
- To gain the knowledge about problem soils and their reclamation as well as analytical knowledge on soil available nutrients.

Theory

Unit I-Soil fertility and Plant nutrition

Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements-

functions, deficiency systems, Plant nutrient toxicity symptoms and remedies measures.

Unit II- Fertilizers and Manures

Fertilizers – Definition - classification –Manufacturing process of nitrogen, phosphorus, potassium, secondary and micronutrient. Manures – definition- classification – effect on soils and plants. Fertilizer control order.

Unit III- Nutrient transformation

Fate of applied major, secondary and micronutrients in soils and its effect on soil properties

Unit IV- Problem soils and Soil organic matter

Acid, calcareous and salt affected soils – characteristics and management. Soil organicmatter, Role of microorganisms in organic matter- decomposition – humus formation. Importance of C: N ratio and pH in plant nutrition, soil buffering capacity.

Unit V- Soil fertility evaluation and Fertilizer use efficiency

Soil fertility evaluation and methods, critical limits of plant nutrient elements and hunger signs. Luxury consumption, nutrient interactions. Soil test crop response and targeted yield concept. Integrated plant nutrient management. Methods of fertilizer application. Bio fertilizer. Fertilizer use efficiency and management. Effect of potential toxic elements in soil productivity. Current streams of thoughts

Lesson plan

Theory lecture schedule

Soil fertility and productivity –definition- types- factors influencing soil fertility and crop productivity.

1. Nutrient elements - essential nutrients- criteria of essentiality – beneficial and functional nutrients- N, P and K nutrients -functions, deficiency and toxicity symptoms.
2. Secondary and micronutrients- functions, deficiency and toxicity symptoms.
3. Concepts and approaches of soil fertility evaluation - Liebig's Law, Mitscherlich's law andray's nutrient mobility concept.
4. Approaches - Deficiency symptoms, tissue analysis, biological tests and chemical tests.
5. Fertilizers - Definition, classification of N,P and K fertilizers
6. N fertilizers- Urea, ammonium sulphate, ammonium nitrate, CAN properties and their reactions in soil- Manufacture of urea and ammonium sulphate
7. P fertilizers- Rock phosphate, bone meal, basic slag, single super phosphate,diammonium phosphate, triple super phosphate, properties and their reactions in soil
8. Manufacturing of SSP and DAP
9. K fertilizers- MOP and SOP- properties and reactions in soil
10. Syntheses of MOP and SOP
11. Complex fertilizers- definition, manufacture of ammonium phosphate, nitrophosphate andN, P, K complexes
12. Mixed fertilizers-definition, preparation and compatibility

13. Preparation and characteristics and compatibility - Specialty/ Customized fertilizers, Watersoluble fertilizers, liquid fertilizers, Micro nutrient mixtures and chelated micronutrients
14. Fertilizer Control Order
15. Organic manures- Definition, and difference between manures and fertilizers-classification of manures with suitable examples- importance of manures in soil fertility management.
16. Composting techniques- Aerobic and anaerobic (Bangalore and Coimbatore method)enriched FYM and vermicompost. Composting of organic waste-Sugarcane trash andcoir waste.
17. **Mid Semester Examination**
18. Nutrients transformations in soil- ionic forms of plant nutrients in soil-mass flow, diffusion, root interception and contact exchange.
19. Sources, forms, mobility, transformation, fixation, losses and availability of nitrogen in soil
20. Sources, forms, mobility, transformation, fixation, losses and availability of phosphorus in soil
21. Sources, forms, mobility, transformation, fixation, losses and availability of potassium and in soil
22. Sources, forms, mobility, transformation, fixation, losses and availability of calcium magnesium and sulphur in soil
23. Sources, forms, mobility, transformation, fixation, losses and availability of micronutrients in soil
24. Problem soils- definition- classification-acid, salt affected soils (saline, alkali/sodic and saline alkali/sodic)-field diagnosis-characteristics-formation nutrient availability in these soils.
25. Reclamation measures of acid soil-lime requirement and saline, sodic and saline sodic- gypsum requirement a calcareous soil.
26. Humus formation-importance of C:N ratio and pH in plant nutrition, soil buffering capacity.
27. SOM maintenance - Role of SOM in sustaining soil health
28. Concepts and approaches of soil fertility-Liebig's Law, Mitcherlich Law and Bray's nutrientmobility concept.
29. Techniques/ methods of soil fertility evaluation - Inductive, deductive, 'A' value technique, crop logging, critical level,Luxury consumption, hidden hunger, DRIS, indicator plants and agronomic approach
30. Methods of fertilizer application for different soil types - Fertigation - Definition water Soluble fertilizers
31. Bio-fertilizers – definition – classification with suitable examples- importance ofimportance of manures in soil fertility management.
32. Nutrient management concepts - INM, STCR, IPNS, SSNM and RTNM.
33. Nitrogen use efficiency - Slow release N fertilizers - Significance and enhancementTechniques.
34. Nutrient use efficiency of P, K and micronutrients and their enhancement techniques

Practicals

1. Estimation of available nitrogen in soils
2. Estimation of available phosphorus in soils
3. Estimation of Potassium and calcium and magnesium in soils
4. Estimation of available sulfur and micronutrient in soil
5. Estimation of soil organic carbon
6. Determination of boron and chlorine content in soils
7. Estimation of gypsum requirement in sodic soil
8. Estimation of lime requirement in acid soils
9. Sampling of organic manure and fertilizer for chemical analysis
10. Physical properties of organic manure and fertilizers.
11. Estimation of Total nitrogen in urea and farmyard manure.
12. Estimation of ammonical nitrogen and nitrate nitrogen in ammonical fertilizer.
13. Estimation of water soluble P_2O_5, Ca and S in SSP, Lime and Gypsum.
14. Estimation of Potassium in MOP/SOP and

15. Estimation of Zinc in zinc sulphate.
16. Visiting of fertilizer testing laboratory.
17. Practical Examination.

Course Outcome

CO1: The students get knowledge on various kinds of problematic soilsCO2:
The students will learn how to maintain the soil health.
CO3: The students acquire practical knowledge of nutrient analysis soil.
CO4: The students gain knowledge on nutrients essential for crop growth and developmentCO5:
The knowledge gained useful in making decisions on nutrient dose, choice of fertilizers/manures and method of application etc

CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	1	-	-	1
CO2	1	2	1	1	-	-
CO3	1	1	1	-	-	-
CO4	-	2	-	1	-	1
CO5	1	2	1	1	1	-

References

1. Dilip Kumar Das, 2007. Micronutrients: Their behaviour in soils and plants. Kalyani Publishers, New Delhi.
2. Gupta, P. K. 2012. A Handbook of Soil, Fertilizer and Manure. Agrobios (India), Jodhpur.
3. John L. Havlin, James D. Beaton, Samuel L. Tisdale and Werner L. Nelson. 2011. Soil Fertility and Fertilizers- An Introduction to Nutrient Management. PHL Learning Pvt. Ltd., New Delhi.
4. Kolay, A.K 2007. Manures and Fertilizers. Atlantic Publishers and Distribution (P)
5. Mengel, K., E.A. Kirkby, H. Kosegarten and T. Apple. 2006. Principles of Plant Nutrition, 5th ed. Springer International.

e-resources

1. www.fspublishers.org/ijab/past-issues/IJAB Vol_5_No_3/47.pdf
2. www.springerlink.com/index/IQ11256h8t325054.pdf.

23 HOR 102 PRODUCTION TECHNOLOGY FOR FRUITS AND PLANTATION CROPS (2+1)

Learning objectives

- To impart knowledge on cultural management of Tropical fruit crops.
- To impart knowledge on cultural management of Subtropical fruit crops.
- To impart knowledge on cultural management of Temperate fruit crops.
- To impart knowledge on cultural management of Arid and Semi-Arid zone fruit crops.
- To impart knowledge on cultural management of Plantation crops.

Theory

Unit I: Introduction and Major fruit crops:
Importance and Scope of fruit and plantation crop industry in India. Importance of rootstocks.
Production technology of major fruits-Mango, Banana, Citrus.

Unit II: Tropical and Subtropical fruit crops:

Production technology of Guava, Sapota, Grape, Pineapple, Papaya, Fig and Iitchi

Unit III: Temperate fruit crops:
Production technology of Apple, Pear, Peach, Plum strawberry

Unit IV: Arid and Semi-Arid zone fruit crops:
Production technology of Minor fruits -Aonla, Jamun, Date palm, Ber, Pomegranate andJackfruit.

Unit V: Plantation crops:
Production technology of Coconut, Arecanut, Cashew, Tea, Coffee, Rubber, Oil palm and

Palmyrah and current stream of thoughts

Practicals

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Training and Pruning in Fruit andPlantation crops preparation of plant bio regulators and their uses, Important pests, diseases and physiological disorders of above fruit and plantation crops. Visit to commercial orchards and plantations and current stream of thoughts.

Lesson plan

Theory Schedule

1. Importance and scope of fruit and plantation crop industry in India. Importance ofrootstocks.
2.& 3. Production technology of Mango.
4.& 5. Production technology of Banana.
6.& 7. Production technology of Citrus.
8. Production technology of Guava.
9. Production technology of Sapota.
10. Production technology of Grapes.
11. Production technology of Pine apple.
12. Production technology of Papaya.
13. Production technology of Fig.
14. Production technology of Litchi
15.& 16. Production technology of Apple.
17. Mid Semester Examination
18. Production technology of Pear and Peach.
19. Production technology of Plum
20. Production technology Strawberry.
21.Production technology of Aonla and Jamun.
22. Production technology of Date palm and Ber.
23. Production technology of Pomegranate and Jackfruit.24.&
25. Production technology of Coconut.
26. Production technology of Arecanut and Cashew.
27.&28. Production technology of Tea.
29.&30. Production technology of Coffee.
31.&32.Production technology of Rubber.
33. Production technology of Oil Palm.
34. Production technology of Palmyra.

Practical Schedule

1. Seed propagation.
2. Scarification and stratification of seeds.
3. Propagation methods for fruits and plantation crops.
4. Description and identification of fruits.
5. Bearing habits in Fruit crops.
6. Practicing Training and Pruning in Fruit crops.
7. Practicing calculation and application of manures and fertilizers.
8. Preparation of plant bio regulators and their applications.
9. Important pests and diseases of fruit crops.
10. Practicing training and pruning methods followed in Tea and Coffee
11. Physiological disorders of Fruit and Plantation crops.
12. Practicing harvesting and postharvest handling of Fruit crops.
13. Visit to state Rubber farm.

14. Visit to papain extraction unit.
15. Visit to commercial orchards.
16. Visit to commercial plantations.
17. Final Practical examination

Course outcomes

CO 1: The students will be able to practice the production technology aspects of Tropical, Subtropical, Temperate and Arid zone fruits.
CO 2: The students can demonstrate Sexual and Asexual method of propagation in Fruitcrops.
CO 3: The students can demonstrate important production techniques and diagnose problemsin cultivation of tropical and arid zone fruits.
CO 4: The students will be able to practice the production technology aspects of Plantationcrops.
CO 5: The students can demonstrate important production techniques and diagnose problemsin cultivation of Plantation crops.

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	1	2	0
CO 2	3	2	1	2	1	0
CO 3	3	3	1	1	2	0
CO 4	3	3	1	1	2	0
CO 5	3	2	1	1	2	0

References

1. Veeraraghavathatham, D., M. Jawaharlal, S. Jeeva and S. Rabindran 1996. ScientificFruit culture, Suri Associates, Coimbatore.
2. Bose, T.K. 1988. Fruits of India – Tropical and Sub-tropical, Naya Prakash Publications, Calcutta.
3. Gardner, V.R., F.F. Bradford and H.D. Hooker. 1952. Fundamentals of fruit production.Mc Graw Hill Book Co., Inc. London.
4. Kumar N, A. Khader P. Rangaswami and Irulappan I. 2000. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford and IBH.
5. Peter, K.V. 2002. Plantation crops – National Book Trust of India – New Delhi.

e- resources

1. www.fruits-mg.com
2. www.hort.purdue.edu/newcrop/morton
3. http://www.indianspices.com/
4. http://indiacoffee.org./
5. http://cpcri.nic.in/

23 EXT 102 FUNDAMENTALS OF AGRICULTURAL EXTENSION EDUCATION (2+1)

Learning objectives

- To improve the knowledge level of the students on concepts, Principles of Extension Education, various extension teaching methods and information sources.
- To acquaint the students with Agricultural journalism, Innovation Decision Process and capacity building of various stake holders.
- To identify and understand various information sources for effective transfer oftechnology.
- To understand the scope and importance of agricultural journalism and state the sourcesof news and types.
- To gain knowledge on capacity building among the target groups.

Theory

Unit I: Extension Education, Programme planning and Administration

Extension Education - Meaning, definition, scope & process, Objectives & principles of extension education, Extension programme planning: meaning & principles, Steps in programme planning, Extension administration: Meaning, concept, functions & principles. Monitoring & Evaluation – concept, definition & types, Differences between monitoring & evaluation & importance of evaluation in agricultural extension.

Unit II: Communication Methods and Techniques

Communication - Meaning, definition, elements & characteristics. Models: Aristotle, Shannon& weaver, Schramm, Paul Leagans, Westley, Macclean & Litterer, Concepts to related to Communication- Empathy, redundancy, fidelity, frame of reference, entropy. Barriers to communication, Extension teaching methods - Definition, functions & classification, Media mix, selection & combination of extension teaching methods, Agricultural journalism: Meaning,Scope, importance & characteristics.

Unit III: Diffusion and adoption of innovation

Factors determining news value, types and sources of news, Diffusion and adoption - Meaning& Definition steps in adoption process: 5 stage & 7 stage models. Concepts of Innovation, attributes of innovation, over adoption & rate of adoption. Adopter categories- characteristics& classification, Innovation decision process: Meaning, definition & stages, Factors influencingrate of adoption.

Unit IV: Transfer of technology, Reforms & New trends in agricultural extension

Transfer of technology: Concept & models with examples, Reforms in Agricultural Extension - ATMA, SREP, Gap Analysis, New trends in agricultural extension - Privatization of extension, meaning, factors influencing privatization, Privatization - merits & demerits and strategies with examples. Cyber extension meaning, features, successful models, Kisan call centers, farmers call centers: Meaning. Objectives, operational mechanism, Market led extension: Meaning, enhanced roles of agriculture extension personnel in light of market led extension, Difference between TOT & market led extension. Indigenous Technical Knowledge

- Meaning, Definition, Methods of Documentation, Farmers led extension- Meaning, Examples.Expert system in agriculture - Meaning, components, examples

Unit V: Capacity building of extension personnel and farmers:

Training meaning, concept & types of training - pre service, in-service, orientation, induction, refresher training, Training to farmers & farm women: time, duration & venue, short term, midterm & long term. FTC, KVK, DAATC: mandate & objectives PRA: Meaning, techniques and importance in Agricultural Extension and current stream of thoughts

Practicals

Understanding university extension system and KVK centers of Agricultural University - Group discussion and practicing brainstorming -Preparation and use of audio-visual aids, extension literature- Leaflets, folders - Preparation and Presentation of power point - Preparation of training schedule - Assess training needs - Understanding the problems being encountered bythe villagers through PRA exercise - Organization and functioning of DRDA and other development departments at district level - NGOs in rural development - Understanding PRA

techniques and their application in village development - Exposure to mass media centers - community radio and television studio for understanding the process of programme production

- Planning and writing of scripts for radio print media and electronic media - Adoption of agricultural technologies

Lesson plan

Theory Schedule

1. Extension education: Meaning, definition, scope & process
2. Objectives & principles of extension education
3. Extension programme planning: meaning & principles
4. Steps in programme planning
5. Extension administration: Meaning, concept, functions & principles.
6. Monitoring & Evaluation – concept, definition & types
7. Differences between monitoring &evaluation & importance of evaluation in agricultural

extension.

8. Communication - Meaning, definition, elements & characteristics. .
9. Models: Aristotle, Shannon & weaver, Schramm, Paul Leagans, Westley, Macclean &Litterer
10. Concepts to related to Communication- Empathy, redundancy, fidelity, frame of reference, entropy. Barriers to communication
11. Extension teaching methods - Definition, functions & classification
12. Media mix, selection & combination of extension teaching methods
13. Agricultural journalism: Meaning, Scope, importance & characteristics
14. Factors determining news value, types and sources of news
15. Diffusion and adoption - Meaning & Definition steps in adoption process: 5 stage & 7 stagemodels.
16. Concepts of Innovation, attributes of innovation, over adoption & rate of adoption
17. **Mid Semester Examination**
18. Adopter categories-characteristics & classification, Innovation decision process: Meaning, definition & stages
19. Factors influencing rate of adoption
20. Transfer of technology: Concept & models with examples
21. Reforms in Agricultural Extension - ATMA, SREP
22. Gap Analysis
23. Privatization of extension, meaning, factors influencing privatization
24. Privatization - merits & demerits and strategies with examples.
25. Cyber extension meaning, features, successful models
26. Kisan call centers, farmers call centers: Meaning. Objectives, operational mechanism
27. Market led extension: Meaning, enhanced roles of agriculture extension personnel in lightof marketled extension
28. Difference between TOT & market led extension.
29. Indigenous Technical Knowledge - Meaning, Definition, Methods of Documentation
30. Farmers led extension- Meaning, Examples.
31. Expert system in agriculture - Meaning, components, examples
32. Training meaning, concept & types of training - pre service, in-service, orientation,induction, refresher training
33. Training to farmers &farm women: time, duration & venue, short term, midterm &long term. FTC, KVK, DAATC: mandate & objectives
34. PRA: Meaning, techniques and importance in Agricultural Extension and currentstream of thoughts

Practical schedule

1. Visit to the KVK center of Agricultural University
2. Group discussion and practicing brainstorming
3. Preparation and use of audio-visual aids
4. Preparation of extension literature-Leaflets, folders
5. Preparation of power point presentation
6. Presentation of power point slides
7. Preparation of training schedule
8. Visit to a village to conduct survey to assess training needs
9. Visit to a village to conduct resource inventory through PRA exercise
10. Visit to DRDA, to study the organizational setup and antipoverty programmes at districtlevel
11. Visit to an NGO and learning from their experience in rural development.
12. Understanding PRA techniques and their application in village development planning.
13. Visit to community radio/television studio for understanding the process of

programme production.

14. Planning and writing of scripts for radio.
15. Planning and writing of scripts for print media and Electronic media
16. Survey on adoption of agricultural technologies.
17. Final Practical Examinations

Course Outcome

At the end of the course students will be able to

CO 1: Understand fundamentals of extension education.
CO 2: know the concepts related to communication
CO 3: Gain expertise to conduct PRA exercise
CO 4: Expose on Extension activities of different organizations.
CO 5: Gain knowledge about to TOT and capacity building

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	2	0	3	3
CO2	1	1	0	3	0	3
CO3	0	2	2	0	3	0
CO4	2	0	1	0	0	3
CO 5	0	0	-	0	0	3

References

1. Ray, G. L.1991, Extension Communication and management. Naya Prakashan, Kolkata.
2. Sandhu, A. S. 1993. Text book on Agricultural Communication: Process and methods.Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
3. Rogers, E. M. 1995. Diffusion of innovations. Free Press, New York.
4. Yella Reddy, N.1998, Audio Visual Aids in Teaching, Training and Extension. ArithaPublishing House Hyderabad.
5. Meenambigai J and C. Thatchinamoorthy, 2018. Text book of Extension communicationand Information Technology, Agro Tech Publishing Academy, Udaipur.

e-resources

1. https://ecourseonline.iasri.res.in
2. https://www.iaritoppers.com
3. https://www.researchgate.net
4. https://agriyan.in
5. https://www.rlbcav.ac.in

23 AEC - 101FUNDAMENTALS OF AGRICULTURAL ECONOMICS(1+1)

Learning objectives

- To provide knowledge to students about basic concepts of economics
- To explain its relevance and importance in agricultural science
- To understand the theory of production
- To know the theory of exchange and distribution
- To provide knowledge to national income and inflation

Theory

Unit I: Nature and Scope of Economics

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Economic systems: Concepts of economy and its functions, Important features

of capitalistic, socialistic and mixed economies. Agricultural economics: meaning,definition, characteristics of agriculture.

Unit II: Theory of Consumption

Utility theory; law of diminishing marginal utility, equi-marginal utility principle. Indifference curve analysis and properties, budget line - Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Demand: meaning, law of demand, schedule and demand curve, determinants, Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.

Unit III: Theory of Production

Production: process, creation of utility, factors of production, input output relationship-Production function- Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply. Producer's surplus.

Unit IV: Exchange and Theory of Distribution

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

Unit V: Macroeconomic concepts

Public finance -National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification ofmoney, supply, general price index, inflation and deflation. Budget-public revenue and public expenditure. Tax: meaning, direct and indirect taxes, agricultural taxation, VAT/GST.

Economic Planning-its importance, elements of Agricultural Economics- importance and its role in economic development. Agricultural planning and development in the country. Current stream of thought.

Practicals

Basic Concepts -Law of Diminishing Marginal Utility-Law of Equi Marginal Utility-Indifference Curve Analysis-Demand and Supply- Equilibrium Analysis-.Consumer's and Producer's surplus-Elasticity of Demand and Supply-Short and Long run Equilibrium in Perfect Market-National Income Measurement Approaches-.Demographic and Socio-economic Indicators-Consumer Price Index-Human Development Index-Budget Discussion-Taxes-Direct & Indirect Taxes Discussion-Economic Planning & NITI Ayog- Discussion-SDG – Discussion

Lesson Plan

Theory Schedule

1. Economics: Meaning, scope and subject matter, definitions – Wealth, welfare, scarcity and growth definitions. approaches to economic analysis; micro and macroeconomics, positive and normative analysis – deductive and inductive methods.
2. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behaviour – Economic systems: Concepts of economy and its functions, Important features of capitalistic, socialistic and mixed economies.

3. Basic concepts: Goods and services – classification and characteristics. Want – meaning and characteristics, demand, utility, cost and price, wealth, capital, income and welfare.
4. Agricultural economics: meaning, definition, subject matter of agricultural economics, importance and its role in economic development.
5. Utility theory - cardinal and ordinal utility; law of diminishing marginal utility, equimarginal utility principle: definition, assumptions – limitations and applications.
6. Indifference curve analysis and properties – budget line – definition, assumptions, limitations and applications – Consumer's equilibrium and derivation of demand curve.
7. Engel's Law of Family Expenditure – Consumers surplus: definition and importance.
8. Demand: meaning, kinds of demand, law of demand, demand schedule and demand curve, determinants of demand, Demand function-Extension and contraction Vs Increaseand decrease in demand. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity – Factors influencing elasticity of demand – Importance of elasticity of demand

9. Mid Semester Examination

10. Production: process, creation of utility, factors of production, definition and characteristics - Input Output Relationship. Production function
11. Supply: Stock versus supply, law of supply, supply schedule, supply curve, Supply and its determinants of supply, supply function, elasticity of supply.
12. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition;
13. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of Rent and Ricardian theory of rent - Quasi rent - Wages: Real wage and money wage. Interest: Pure interest and gross interest –Profit: Meaning of economic profit.
14. National income: Meaning and importance, circular flow, Concepts of national income - accounting and approaches to measurement, difficulties in measurement.
15. Population: Importance, Malthusian and Optimum population theories Natural and socio-economic determinants, current policies and programmes on population control.
16. 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, inflation – meaning, definition, types of inflation
17. Welfare economics – meaning – Pareto optimality-Consumer Banking: Role in modern economy Public revenue and public expenditure. Tax: meaning, direct and indirect taxes, Cannons of taxation - agricultural taxation, VAT and GST.

Practical schedule

1.Basic Concepts
2.Law of Diminishing Marginal Utility
3.Law of Equi Marginal Utility
4.Indifference Curve Analysis
5.Demand and Supply- Equilibrium Analysis
6.Consumer's and Producer's surplus
7.Elasticity of Demand and Supply
8.Short and Long run Equilibrium in Perfect Market
9.National Income Measurement Approaches
10.Demographic and Socio-economic Indicators

11.Concumer Price Index
12.Human Development Index
13Budget Discussion
14.Taxes- Direct & Indirect Taxes Discussion
15.Economic Planning & NITI Ayog Discussion
16.SDG -Discussion
17. Final Practical Examination

Course Outcome

At the end of the course students will be able to
CO 1: To understand the important concepts on micro and macro economics.
CO 2: To know the principles of economics and its application
CO 3: To acquire the practical exposure on application of economic principles related to agriculture.
CO 4: To work out the measurement of Human Development Index, welfare indicators.
CO 5: To understand the concepts like GDP, GNP and Inflation.

CO-POMapping matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	-	-	-	-
CO2	2	-	-	2	-	2
CO3	-	-	2	2	-	1
CO4	1	-	1	-	-	-
CO5		2			2	

References

1.Dewett,K.K., 2010. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2.SubbaReddy,S.etal.,2013.
Agricultural Economics, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3.Seth,M.L.2005.Principles of Economics, Lakshmi Narain Agarwal Co., Agra, New Delhi.4.Sankaran,S.,2000.PrinciplesofEconomics,ProgressiveCorporationPvt.,Chennai.
5.Samuelson,P., 2004. Economics, TataMcGraw Hill Publishing Co.,Ltd.,New Delhi.

e-resources

1.https://www.iaritoppers.com/
2.https://www.studocu.com/row/document/moi-university/economics/agricultural-economics-ii-notes-eco-417/8178235
3.http://www.jnkvv.org/PDF/02042020171537Lecture-1%20(3%20files%20merged).pdf
4.https://en.wikipedia.org/wiki/Principles_of_Economics

5.https://open.umn.edu/opentextbooks/textbooks/32

23 EXT 112 HUMAN VALUES AND ETHICS* (1+0) (NON-GRADIAL)

Learning objectives

- To understand the concepts of human values and ethics
- To gain knowledge about virtues and goals in life
- To develop interpersonal skills and ethical decision making
- To know the professional ethics in agricultural research
- To enhance gender sensitivity and emotional intelligence

Theory

Unit I: Human Values

Human values – definition – concepts – culture and values – socialization – evaluation of human values – types of values. Ethics – introduction – origin of ethics – meaning – types of ethics – ethical issues – ethical conflict – national differences in ethics – ethical behaviours, ethics vs. morals and values.

Unit II: Virtues & Goals

Virtues – civic virtues – civic knowledge – self restraint – self assertion – self reliance – respect for others – living peacefully – caring, sharing, honesty, courage, valuing time,cooperation, commitment, empathy, self confidence. Goals in life – steps in goal setting – SMART Goals, mission for life – linking mission to goal setting – vision of life – driving one self to success – self esteem and self confidence. Art of self improvement – self exploration – self awareness – putting capabilities to use – SWOT analysis.

Unit III: Personality Development

Personality development – definition – elements and stages of personality development. Attitudes of attachment and detachment. Interpersonal skills – delegation, humour, trust, expectations, values, status, compatibility and their role in building team work – resolving conflicts. Ethical decision making – role of moral philosophies in decision making – difficulties in decision making – ethical reasoning – levels of decision making. Ethics in media and technology – impact on youth, cyber ethics and etiquette, mobile phones, social networking – correct and judicious use.

Unit IV: Spirituality and Positive Thinking

Positive spirit – anatomy of the self – the mind – the intellect – the sub conscious mind –consciousness - the cyclic process within the self – states of awareness – innate andacquired qualities of the self – power to act. Spirituality – concepts, nature and identity of god –form or image – attributes – relationship – purpose and benefits – power and acts – meditation – transmitter and receiver – morality and religion. Positive thinking – assertiveness – coping with life stresses – peer pressure – suicidal tendencies – addiction – substance abuse.

Unit V: Professional ethics

Professional ethics – code of professional ethics in agricultural research – organizational ethics – violation of code of ethics – causes and consequences – whistle blowing. Gender issues and gender sensitivity at work place – legal provisions. Managing emotions – anger, frustration, helplessness etc, emotional intelligence – meaning and role in leading a balanced life. Case study on ethics & values and current stream of thoughts.

Lecture Plan

Theory schedule

1. Human values – definition – concepts – culture and values – socialization – evaluation of human values – types of values.
2. Ethics – introduction – origin of ethics – meaning – types of ethics – ethical issues – ethical conflict – national differences in ethics – ethical behaviour, ethics vs. morals and values.
3. Virtues – civic virtues – civic knowledge – self restraint – self assertion – self reliance – respect for others – living peacefully – caring, sharing, honesty, courage, valuing time, cooperation,

commitment, empathy, self confidence.

4. Goals in life – steps in goal setting – SMART Goals, mission for life – linking mission to goal setting – vision of life – driving one self to success – self esteem and self confidence.
5. Art of self improvement – self exploration – self awareness – putting capabilities to use – SWOT analysis.
6. Personality development – definition – elements and stages of personality development.Attitudes of attachment and detachment.
7. Interpersonal skills – delegation, humour, trust, expectations, values, status, compatibilityand their role in building team work – resolving conflicts.
8. Ethical decision making – role of moral philosophies in decision making – difficulties in decisionmaking – ethical reasoning – levels of decision making.
9. **Mid Semester Examination**
10. Ethics in media and technology – impact on youth, cyber ethics and etiquette, mobile phones, social networking – correct and judicious use.
11. Positive spirit – anatomy of the self – the mind – the intellect – the sub conscious mind – consciousness - the cyclic process within the self – states of awareness – innate and acquired qualities of the self – power to act.
12. Spirituality – concepts, nature and identity of od – form or image – attributes – relationship – purpose and benefits – power and acts – meditation – transmitter and receiver – morality and religion.
13. Positive thinking – assertiveness – coping with life stresses – peer pressure – suicidal tendencies – addiction – substance abuse.
14. Professional ethics – code of professional ethics in agricultural research – organizational ethics – violation of code of ethics – causes and consequences – whistle blowing.
15. Gender issues and gender sensitivity at work place – legal provisions.
16. Managing emotions – anger, frustration, helplessness etc, emotional intelligence – meaning and role in leading a balanced life.
17. Case study on ethics, values and current stream of thoughts.

Course Outcome

At the end of the course students will be able to

CO 1: Understand the concepts of human values and ethicsCO 2:

Gain knowledge about virtues and goals in life

CO 3: Develop interpersonal skills and ethical decision making

CO 4: Know the professional ethics in agricultural research CO 5:

Enhance gender sensitivity and emotional intelligence

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	3	1	0	2
CO2	0	1	3	2	1	3
CO3	0	2	2	0	1	3
CO4	0	1	3	0	1	2
CO 5	1	1	3	1	1	3

References

1. R. S. Naagarazan, 2006. Professional Ethics and Human Values –, New Age International Publishers.
2. Samita Manna and Suparna Chakraborthi, 2010. Values and Ethics in Business andProfession, PHI Learning Pvt Ltd, New Delhi.
3. Jagannadham Challa, 2018 . Scientific Values and Professional Ethics in AgriculturalResearch – Principal Scientist, HRD, NAARM, Rajendranagar, Hyderabad – 500 030.

4. Anil, 2019. Ethical Issues in Agricultural Research, Technology and Intellectual PropertyRights.
5. Bhanwar Lal Dhaka, Kirti and Pankaju kumar Ojha 2021, Human Values and Ethics,Kalyani Publishers, New Delhi.

e-resources

1. https://www.resaearchgate.net
2. https://www.agrigyan.in
3. https://www.agrimoon.com
4. https://ecourses.icar.gov.in
5. https://www.ndpublisher.in

IISemester

AGR 201 WEED MANAGEMENT (1+1)

Learning objectives

- To develop the mastery of weed identification.
- To understand different methods of weed management including herbicides, their mode ofaction and selectivity and resistance for the effective weed control.
- To understand and develop technical knowledge on different herbicides and their usage, computation of herbicide doses.
- To acquire skills on herbicide application for better herbicidal effects and weedmanagement.

Theory

Unit I: Weed biology and ecology

Introduction to weeds- definitions, characteristics of weeds, their harmful and beneficial effectson the ecosystem. Classification, reproduction and dissemination of weeds. Weed seed dormancy – crop weed competition, allelopathy and its application for weed management.

Unit II: Principles of weed management

Concepts of weed prevention, control and eradication. Methods of weed management- cultural, mechanical, chemical, biological and biotechnological methods. Integration of herbicides with non-chemical methods of weed management and IWM.

Unit III: Herbicides

Herbicides- definition, advantages and limitation of herbicide usage in India. New developments in herbicides- classification, formulations and methods of application. Conceptof adjuvants, surfactant and their use.

Unit IV: Behaviour of herbicides and herbicide resistance

Introduction to mode of action of herbicides and selectivity. Herbicide absorption and translocation. Compatibility of herbicides with other agro-chemicals. Herbicide residue management- persistence, degradation and herbicide resistance.

Unit V: Weed management

Weed management in field crops. Aquatic, problematic, invasive alien weeds and their management. Sustainable weed management concepts for climate change. Current stream of thoughts.

Practicals

Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; weed seed bank; Biology of problematic weeds; Acquiring skill in mechanical and cultural methods of weed management, use of tools and implements; Calculations on weed indices; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipments and calibration; Methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Economics of weed management practices. Designing integrated weed management practices for various crops.

Lesson plan

Theory Schedule

1. Weeds – Definition, classification and characteristics, harmful and beneficial effect ofweeds.
2. Classification and characteristics of weeds of different agro ecosystems – lowland weeds,irrigated upland and rainfed land weeds.
3. Classification and characteristics of weeds – Aquatic, parasitic and obnoxious weeds.
4. Life cycle of weeds, weed migration, weed seed distribution.
5. Weed dormancy, germination, establishment and perennation of weeds in different ecosystems.
6. Crop weed interactions – Critical crop weed competition, competitive and allelopathiceffects of weeds and crops.
7. Principles and methods of weed management: Preventive, cultural, mechanical.
8. Principles and methods of weed management: chemical, biological and alternate methods.
9. **Mid Semester Examination.**
10. Classification and characteristics of herbicides, methods of herbicide application and herbicide formulations – History and Development.
11. Herbicide use efficiency – Adjuvants, herbicide protectants and antidotes – Herbicide and herbicide mixtures in India – Interaction with moisture, fertilizer and other agrochemicals.
12. Herbicides absorption and translocation – Mechanism of action of herbicides and their selectivity.
13. Herbicide persistence and degradation in plants and soils – Herbicide residue and their management.
14. Herbicide resistant weeds and their impact on weed management.
15. Success of herbicide resistant crops (HRC) in Indian and World agriculture.
16. IWM in crops and cropping systems – Agricultural crops.
17. Aquatic , problematic, invasive alien weeds and their management and sustainable weed management concept for climate change- Current stream of thoughts.

Practical Schedule

1. Identification, classification and characterization of wet land and garden land weeds.
2. Identification, classification and characterization of dry land and aquatic weeds.
3. Identification, classification and characterization of problematic and parasitic weeds.
4. Biology and survey of weeds in cropped area and other habitats.
5. Techniques of weed preservation - Herbarium preparation.
6. Estimation of soil weed seed bank and seed production potential of problematic weeds.
7. Phytosociological survey of weeds
8. Calculations on weed indices(WCE and WI)
9. Study of commonly available herbicides in the market, their nomenclature and labelinformation.
10. Study of herbicide formulations and mixture of herbicides.
11. Computation of herbicide doses.
12. Study of herbicide application equipment and calibration.
13. Herbicide application methods and precautionary measures.
14. Herbicide phytotoxicity scoring under field conditions and its compatibility with agrochemicals.
15. Field study of weed control in cropped and non-cropped areas.
16. Herbicide residue analysis.
17. **Practical examination.**

Course Outcome

CO 1: To create knowledge on facts and information from different sources, pertaining toweed biology and management and be able to explain how they are interrelated; demonstrated

through successful completion of assignments.

CO 2: To critically assess different weed management strategies

CO 3: To synthesis idea about various herbicides, formulations and adjuvants

CO 4: To understand about mechanism and action of herbicides, persistence of herbicides.

CO 5: To construct information regarding management of weeds of field crops, aquatic and problematic weeds.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	1	1	-
CO2	3	2	2	-	-	-
CO3	-	-	2	-	2	-
CO4	-	-	-	-	2	-
CO5	2	1	2	1	2	2

References

1. Das, T.K. 2011. Weed Science – Basics and Applications. Jain Publishers, New Delhi.
2. Gupta, O.P. 2016. Modern Weed Management. Agro Bios (India), Jodhpur.
3. Naidu, V.S.G.R. 2012. Handbook on Weed Identification. Directorate of Weed Science Research, Jabalpur.
4. Rao, V.S. 2011. Principles of Weed Science. Oxford and IBH Publishing Co., New Delhi.
5. Tadulingam, C. and Venkatnarayana, D. 2018. A Handbook of Some South IndianWeeds. Agri BioVet Press, New Delhi.

e-resources

1. https://www.invasive.org/gist/products/handbook/methods-handbook.pdf
2. https://croplife.org/wp – content/uploads/2014/04/Implementing – Integrated – Weed – Management – for – Herbicide – Tolerant – Crops.pdf.
3. https://doi.org/10.3389/fagro.2019.00003.
4. http://courseware.cutm.ac.in/wp-content/uploads/2020/05/weed-management-E-material.pdf.
5. http://www.jnkvv.org/PDF/030420201641453420101l.pdf

23AGR 202 INTRODUCTORY TO FORESTRY (1+1)

Learning objectives

- To acquire knowledge on the basic aspect of Forestry.
- To conceptualize the importance of forests and Agro forestry system.
- To impart knowledge on Agroforestry systems as an essential eco-friendly mechanism in productivity of agro-ecosystems.
- To learn about artificial regeneration and manmade forestry
- To learn about techniques of tree planting and its management.

Theory

Unit I: Forest and its importance

Forest- definitions of basic terms. Role and functions of forests. Forest classification- Social forestry, farm forestry, agro forestry, community forestry, industrial forestry and urban forestry,forest Influences. Scope of forestry- types of forest in World, India and Tamil Nadu. Salient features of national forest policies.

Unit II: Forest regeneration

Forest regeneration- objectives- natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers. Artificial regeneration-Man made plantations. Factors determining regeneration. Nursery technique. Forest plantation. Tending operations – weeding, cleaning, thinning – mechanical,

ordinary, crown and advance thinning.

Unit III: Forest mensuration

Forest mensuration- objectives, diameter measurement, instruments used in diameter measurement. Non instrumental methods of height measurement - shadow and single pole method. Instrumental methods of height measurement - geometric and trigonometric principles. Instruments used in height measurement. Measurement of tree diameter, tree height, age and growth rate and tree stand.

Unit IV: Agroforestry

Agroforestry- concept, definitions, importance, benefits, limitations. Criteria of selection oftrees in Agroforestry. Classification of different agro forestry systems prevalent in the country- Shifting cultivation, taungya, alley cropping, wind breaks, shelter belts and home gardens. Criteria for selection of AF Trees.

Unit V: Silviculture

Silviculture- definition, objectives. Plant classification – Crown, stem, roots locality, Plantsuccession- Cultivation practices for importance trees. Silviculture practices for important fast growing tree species of the region. TBO's, MPTS and NFTS- Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias and Current stream of thoughts.

Practicals

Identification of trees-Seeds and seedlings of important agroforestry species-Seed treatments - Forest nursery-types-Layout-bed preparation-Nursery technology of important tree species- Forest mensuration- Visit and study of different agroforestry systems- Biomass estimation in Energy plantations- Economics- Forest plantations and their management- Visit to foresttraining college- Visits of nearby forest based industries.

Lesson plan

Theory Schedule

1. Introduction- Introduction to Indian forest, target area, productivity - Definitions of basicterms related to forestry – Role, functions and scope of forestry.
2. Classification of forest- Social forestry, Community forestry, Extension forestry, Farm forestry, Industrial forestry and urban forestry.
3. Types of forest in India and Tamil Nadu.
4. National Forest Policies including Agro forestry policies.
5. Forest regeneration- Natural and Artificial Regeneration methods- seed and vegetativeparts.
6. Artificial regeneration- man made plantations -coppicing, pollarding, root suckers choice between natural, essential preliminary considerations.
7. Nursery management practices in forestry.
8. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.
9. Mid – semester examination.
10. Forest mensuration- Objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method- Instrumental methods of height measurement.
11. Geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.
12. Agroforestry-concept - definitions, importance, benefits, limitations -criteria of selection of trees in Agroforestry
13. Planning for agroforestry – constraints, diagnosis and design methodology.
14. Selection of tree crop species for agroforestry
15. Classification of different agro forestry systems prevalent in the country, shifting cultivation, Taungya, Alley cropping, Home gardens, multitier cropping, Wind breaks and Shelter belts.

16. Silviculture- definition- objectives- cultivation practices for important trees TBO‘s, MPTS and NFTS.
17. Silvicultural practices for Ailanthus, Neem, Pungam, Prosopis, Casuarina, Silk cotton, Bamboo and Acacias and Current stream of thoughts.

Practical Schedule

1. Identification of tree species suitable for Timber, Fuel wood and Fodder
2. Identification of tree species suitable for Roadside plantation, Field bunds, Windbreaksand for Wastelands
3. Identification of Minor forest tree species, trees for Beautification purpose and Nitrogenfixing tree species and other species suitable for Agroforestry
4. Identification of seeds of important tree species
5. Collection, Extraction and Storage of tree seeds
6. Collection, Extraction and Storage of tree seeds
7. Application of Pre-sowing Seed Treatment to tree seeds
8. Nursery, types, importance of nursery and criteria for nursery site selection.
9. Nursery methods for important silviculture tree species – Mother bed – raised bed andsunken bed
10. Biomass estimation in Energy plantations.
11. Cost of cultivation of Commercial trees.
12. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees
13. Height measurement of standing trees by Shadow method, Single pole method and Hypsometer.
14. Volume measurement of logs using various formulae.
15. Forest plantations and their management.
16. Visits of nearby forest based industries.
17. **Practical examination**.

Course Outcome

CO 1: Students can learn about the basic aspects of Forestry.
CO 2: Students can understand the importance of forests and Agro forestry system.CO 3: Students acquire knowledge about the minor forest products.
CO 4: Students can learn about the aging of tree species.
CO 5: Students learn about techniques of tree planting and its management.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	3	2	1
CO2	2	2	3	-	3	-
CO3	2	3	3	-	2	2
CO4	2	1	3	-	1	2
CO5	3	3	2	3	2	2

References

1. Chauhan SK .2020. Agroforestry , Agrotech Publishing Academy, Udaipur .
2. Indian Society of Agronomy. 1989. Agroforestry System in India. Research andDevelopment, New Delhi.
3. Rex Immanuel R, M. Thiruppathi and A. Balasubramanian. 2018. Social Forestry and Agroforestry: Past Triumphs and Future Horizons. Empyreal Publishing House, Guwahati, Assam.
4. Singh, SP. 2021. Handbook of Agroforestry 3rd ed, Agrotech Publishing Academy, Udaipur .
5. Solanki. KR. 2000. Multipurpose Tree Species: Research, Retrospect and Prospects. Agrobios. Jodhpur, Rajasthan.

e- resources

1. http://ecoursesonline.iasri.res.in/course/view.php?id=157
2. https://vikaspedia.in/agriculture/forestry/agroforestry
3. https://agritech.tnau.ac.in/forestry/agroforestry_index.html

4. http://ecoursesonline.iasri.res.in/Courses/Social%20and%20Farm%20Forestry/FRST201/Start%20to%20read%20the%20Course.html.
5. http://ecoursesonline.iasri.res.in/course/view.php?id=157.

23 AGR 203 CROP PRODUCTION TECHNOLOGY-I (KHARIF CROPS) (1+1)

LEARNING OBJECTIVES

- To impart updated technology and skills in performing different operations in raising of the crops.
- To understand crop statistics and study the constraints for low productivity in India and Tamil Nadu.
- The students will gain knowledge about the Kharif crops and their cultivationtechniques.
- To know cropping systems in India and post-harvest operations for different crops.
- To Learn about seed production, Farm Mechanization and resource conservationtechnology.

THEORY

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield, post-harvest management practices. Value addition and by-products utilization of *Kharif* crops.

Unit I: Cereals and Millets

Cereals – Rice, Maize, Millets – Sorghum, Pearl millet, Finger millet. Minor millets – Foxtail millet, Kodo millet, Common millet, little millet and barnyard millet.

Unit II: Pulses and oil seeds

Pulses – Pigeon pea, Black gram, Green gram, Horse gram and cluster bean.Oil seeds

– Sesame, Soybean, Castor and Jatropha.

Unit III: Fiber crops.

Cotton, jute and mesta

Unit IV: Fodder and Forage crops

Fodder sorghum, fodder maize, cowpea, horse gram, and cluster bean. Forage crops –Stylosanthus, elephant grass and Napier hybrid grass.

Unit V : Green manures and green leaf manures

Green manures – Daincha, Sunnhemp, sesbania, kolingi. Green leaf manures – Glyricida, subabul, pungam, poovarasu, and neem. Insitu incorporation ofgreen manures and green leaf manures. Current stream of thoughts

PRACTICAL

Nursery preparation and transplanting of rice, pearl millet and finger millet. Sowing of maize, soybean, pigeon pea, mungbean, sesame and cotton. Effect of seed size on germination and seedling vigour in the kharif season. The effect of sowing depth on kharif cropgermination, identification of weeds in *Kharif* season crops, Topdressing and foliar feeding of nutrients, a study of yield-contributing characteristics and yield calculation of kharif season crops, a study of crop varieties, and important agronomic experiments at an experimentalfarm. Study of forage experimentation, morphological description of *kharif* season crops. Visit research centers for related crops.

Theory

Lesson Plan

1. Importance, area, production and productivity of cereals and millets in world, India and Tamil nadu. Rice - origin - geographic distribution - economic importance – soil and climatic requirement. Important varieties and hybrids, Transgenic Rice. Rice - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
2. System of Rice Intensification (SRI) – byproduct utilization, quality parameters - post harvesting technology.
3. Maize and sorghum - Origin, geographical distribution, economic importance, soil andclimatic requirements, varieties, cultural practices and yield. Post harvest handling, processing, value addition and by product utilization.
4. Pearl millet and finger millet - origin, geographic distribution, economic importance,soil and climatic requirement, varieties, cultural practices and yield - Post harvest management
5. Minor millets - foxtail millet, little millet, kodo millet, common millet and barnyard millet - Origin, geographic distribution, economic importance, soil and climaticrequirement, varieties, cultural practices and yield. Post harvest management.Importance, area, production and productivity of pulses in world, India and Tamilnadu. Reasons for low productivity of pulses in India and Techniques to improve productivity.
6. Pigeonpea, blackgram and greengram - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield -Post harvest handling, processing, value addition and by product utilization. Agronomy of rice fallow pulses.
7. Importance, area, production and productivity of oilseeds in world, India and Tamilnadu. Reasons for low productivity of oilseeds in India and Techniques toimprove productivity. Sesame - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield -Post harvest management
8. **Mid semester examination**
9. Soybean, Jatropha and castor - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield -Post harvest management
10. Cotton - Origin, geographical distribution, economic importance, soil and climatic requirements - Season and varieties. Cultural practices and yield. Post harvest management and quality parameters. Rainfed cotton - Rice fallow cotton and transgenic cotton. Post harvest management.

11. Jute and Mesta - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
12. Importance of forage crops in Indian agriculture. Fodder maize and fodder sorghum - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield
13. Horse gram, clusterbean and cowpea - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
14. Stylosanthus, Elephant grass and Napier hybrid grass - Origin - geographical distribution - economic importance - soil and climatic requirements – varieties - Cultural practices: Field preparation – Season - Sowing – Water management – Weed management – Nutrient management – Harvesting – Yield. Forage crops. Preservationof fodders - Silage and hay making.
15. Green manures – Daincha, Sunhemp and *S.rostrata*and Kolingi - Importance - Soil and climatic requirement - Cultural practices and yield.
16. Glyricidia, subabul, pongam and neem - Soil and climatic requirement - Cultural practices and yield. *Insitu* incorporation of green manures. Current stream of thoughts

Practical Schedule:

1. Identification of seeds of *kharif* crops
2. Acquiring skill in different seed treatment techniques for *kharif* crops.
3. Practicing various nursery types and main field preparation for rice.
4. Layout and raising of crop cafeteria
5. Acquiring skill in nursery preparation and sowing of important millets.
6. Acquiring skill in main field preparation, manuring and sowing/ transplanting or kharif
7. Study of yield parameters and yield estimation in *kharif* crops.
8. Acquiring skill in harvesting of *kharif* crops
9. Working out cost and returns of *kharif* crops.
10. Study of crop varieties and important agronomic experiments at experimental farm
11. Visit to farmers field / experimental farm to acquire skill in mechanisation.
12. Visit to nearby Forage farm/ Agricultural Research Station / Farmer's field.
13. **Practical examination**.

COURSE OUTCOMES:

CO1: To understand the importance of food grain requirement and cultivationof major cereal crops

CO 2: To gain knowledge about importance of minor millets and its cultivation practices

CO3: To formulate legume based cropping system and production technologies for various pulse crops

CO4: To construct idea regarding knowledge on growing of legume andperennial fodders and its preservation

CO5: To create awareness about role of green manures in soil fertility

CO-PO MAPPINGMATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	2
CO2	2	-	-	-	-	2
CO3	2	2	2	-	-	2
CO4	2	2	2	-	-	2
CO5	2	-	-	-	-	-

REFERENCES

1. Ahlawat, I.P.S., Om Prakash and G.S.Saini.2010. Scientific Crop Production inIndia. Rama Publishing House, Meerut.
2. Rajendra Prasad 2006. Text Book of Field Crops Production. ICAR, New Delhi.
3. Subash Chandra Bose M, Balakrishnan V. 2001. Forage Production. South Asian Publishers, Delhi
4. Singh, C., Singh, P. and Singh, R. 2003. Modern Techniques of RaisingField Crops. Oxford and IBH Publishing Co., Pvt., Ltd., New Delhi.
5. Singh, A.K. 2020. Textbook Series: Introduction to Major Field Crops (As per 5th Deans Committee Syllabus), Agrotech publishing academy, Udaipur.

E-RESOURCES

- ***https://drive.google.com/file/d/1NybJE55HM_dxcZ_z0VU01ji6LSNq_fB3/view***
- ***https://egyankosh.ac.in/bitstream/123456789/32607/1/Unit-11.pdf***
- ***https://www.agrimoon.com/wp-content/uploads/Introduction-to-major-field-crops.pdf.***
- ***https://jru.edu.in/studentcorner/lab-manual/agriculture/LABORATORY%20MANUAL%20CPT.pdf.***
- *https://drive.google.com/file/d/1rACrrSvqJOIwWZScsNmNcR-RZYhUQtSi/view*

23 SOL 201 PROBLEMATIC SOILS AND THEIR MANAGEMENT 2 (1 +1)

Learning Objectives

- To know about the soil and different problem occur during cultivation.
- How to identify the problem and what are the reclamation method requires improving thesoil health.
- Students learn practically about the identification of problem soil and learn different methodto improve soil fertility, that necessary to improve the yield.
- To gain knowledge on the assessment irrigation water quality
- To learn about modern tools to asses the extent of types of problematic soils

Theory

Unit 1 Soil health and Soil quality and Wastelands

Soil degradation: Concept, types, factors and processes. Soil quality and soil health: definition and concept, soil quality indicators. Characteristics of healthy soils. Distribution of Waste land and problem soils in India. Their categorization based on properties

Unit 11- Soil constraints- Chemical

Saline soils, alkali Soils, saline-alkali soils, degraded alkali soils, coastal saline soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Acid and acidsulphate soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Calcareous Soil: definition, formation, characteristics, effect on plant growth, reclamation and management.

Unit III- Soil constraints- Physical and polluted soil

Slow permeable, excessively permeable, surface crusting, sub surface hard pan and fluffy paddy soils. Eroded soils and compacted soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Submerged soils and flooded soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Polluted soils: definition, sources and their remediation. Water pollution: definition, sources and their remediation.

Unit IV- Irrigation Water Quality and Use

Quality of irrigation water – Criteria used for assessing the quality of irrigation water – Water quality appraisal – Effect of poor quality water on soil and crop growth – Management of poor quality irrigation water.

Unit V- Assessment and bioremediation

Remote sensing and GIS in diagnosis and management of problem soils. Land capability and classification, land suitability classification. Problem soils under different agro ecosystems. Bioremediation of problem soils through multipurpose tress (MPTs**).** Current stream of thoughts

Lesson plan

Theory Lecture Schedule

1. Soil quality-Physical, Chemical and Biological indicators and major factors affecting thesoil quality
2. Soil health and Soil health card, its importance to farmer and crop productivity
3. Distribution of Waste land and problem soils in different agro-ecosystem of India
4. Properties and categorization of saline and sodic soils
5. Reclamation and management of Saline and Sodic soils
6. Properties and categorization of acid and acid sulphate soils based on properties
7. Reclamation and management of acid and acid sulphate soils
8. Slow permeable, excessively permeable, surface crusting, sub surface hard pan and fluffypaddy soils. Eroded soils and compacted soils: definition, formation, characteristics, effecton plant growth, reclamation and management
9. **Mid Semester examination**
10. Submerged soils and flooded soils: definition, formation, characteristics, effect on plant growth, reclamation and management. Polluted soils: definition, sources and their remediation. Water pollution: definition, sources and their remediation.
11. Introduction to water quality and its effective usage for irrigation
12. Criteria, classification and standards of irrigation water –an appraisal
13. Management and utilization of saline water for irrigation
14. Remote sensing and GIS in diagnosis of problem soils
15. Remote sensing and GIS utility on management of problem soils
16. Land capability and land suitability classification
17. Bio remediation of soils through multipurpose trees (MPTs), and current stream of thoughts

Practicals

1. Identification of physical problems of soils
2. Determination of soil pH
3. Determination of EC of soils
4. Determination of lime requirement of acid soils (Shoemaker et al.)
5. Determination of gypsum requirement of alkali soils (Schoonover 1952)

6. Determination of calcium carbonate content in calcareous soils
7. Determination of infiltration rates of soils.
8. Estimation of CEC in problem soil
9. Estimation of exchangeable calcium and magnesium
10. Estimation of exchangeable K and Na and ESP
11. Water quality assessment (pH, EC, alkalinity)
12. Determination of Carbonate and Bicarbonate in irrigation water (Richards, 1954)
13. Determination the amount of Chloride in irrigation water.
14. Determination of Ca and Mg content in irrigation water
15. Determination of Na and K content in irrigation water
16. Computation of quality index of irrigation water
17. **Practical examination**

Course outcome

CO1: The students get knowledge about different kind of problem soil in India and their characteristics

CO2: Students gain knowledge in methods of reclamation of problem soils

CO3: The students gain practical knowledge of laboratory to test the problem soil.

CO4 : Identify processes resulting in deterioration of soil physical and chemical properties

CO5: Students gains knowledge on importance of quality irrigation water for soil and crops

CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	-	-	1
CO2	2	1	1	-	-	-
CO3	-	1	1	-	-	-
CO4	1	1	-	-	-	-
CO5	1	1	-	-	1	1

References:

1. Calvet J.C.2019. Soil Pollution. CBS Publishers and Distributors. New Delhi
2. Das, D.K 2013 Introductory Soil Science. Kalyani Publishers, New Delhi
3. Das, D.K.2019 Problematic soils and their management Kalyani Publishers, Delhi
4. Mehra, R.K.2017.Textbook of Soil Science. ICAR, New Delhi
5. Somani. L. L 1990 Alkali Soils and their Reclamation and management. DivyajoytiPrakashan, Jodhpur

e-resources

1. www.agrifair.in
2. www.agristudyinfo.com

23 GPB 201 FUNDAMENTALS OF PLANT BREEDING (2+1)

Learning objectives:

- To expose the students to basic and applied principles of plant breeding.
- To impart knowledge on emasculation and pollination techniques of various crops
- To impart knowledge on breeding methods of self, cross and clonally propagated crops
- To impart knowledge on application of various genetic principles in crop improvement
- To familiarize recent strides in molecular markers.

Theory

Unit I: Reproductive systems in plant breeding

Plant Breeding – definition, concept, Nature, Aims & Objectives and Role. Major Achievements and future Prospects of Plant Breeding. History and Development of Plant Breeding – Genetics in relation to Plant Breeding – Modes of reproduction – Asexual reproduction (Vegetative reproduction and apomixes)

and sexual reproduction – their classification and significance in plant breeding – Modes of pollination – classification of crop species on the basis of mode of pollination – self-pollination – Mechanisms promoting self and cross pollination. Self-incompatibility – classification – utilization in crop improvement. Male sterility – different types – genetic, cytoplasmic and cytoplasmic genetic male sterility –inheritance and maintenance – Utilization of male sterile lines in hybrid seed production – their limitations, advantages and disadvantages.

Unit II: Breeding methods of self-pollinated crops

Genetic consequences of self-pollination, cross pollination and often cross-pollinated crops - Plant introduction – Types, history, purpose, procedure, merits and demerits – plant introduction agencies in India – NBPGR and its activities – germplasm collections, genetic erosion, gene sanctuaries – centers of origin / diversity. Biometrical genetics – definition, qualitative and quantitative characters, role of environment on quantitative characters – biometrical techniques used in plant breeding – Selection – natural and artificial selection – basic principles of selection – selection intensity – selection differential – heritability – genetic advance. Johannsen's pure line theory and its concepts and significance – progeny test. Genetic basis and breeding methods in self-pollinated crops – Mass selection – procedure by mass selection – merits, demerits and achievements. Genetic basis of pure line selection – general procedure for evolving a variety by pure line selection – merits, demerits and achievements – comparison between mass and pure line selection – Hybridization – types of hybridization – pre-requisites of hybridization – procedure / steps involved in hybridization. – Pedigree, bulk method – procedure – merits, demerits and achievements – comparisonbetween pedigree and bulk method – single seed descent method. Back cross method – applications, procedure for transfer of single dominant gene, recessive gene – merits, demerits and achievements, comparison between pedigree and back cross methods – Multiline variety – definition, characteristics, development of multiline varieties and achievements.

Unit III: Breeding methods of cross pollinated crops and clonally propagated crops Population genetics – concepts, Hardy Weinberg law, factors affecting equilibrium frequenciesin random mating populations. Heterosis breeding and Inbreeding depression –Composites and Synthetics – steps in development of synthetics and composites Population improvement – selection without progeny testing – selection with progeny testing – progeny selection – merits and demerits of progeny selection – line breeding – achievements –Recurrent selection – different types – detailed procedure of simple recurrent selection and brief description of other recurrent selection methods – conclusion of the efficiency of different selection schemes. Methods of breeding for vegetatively propagated crops – clone – characteristics of asexually propagated crops – characteristics of clones – importance of a clone – sources of clonal selection – procedure – advantages and disadvantages – problems in breeding asexually propagated crops - genetic variation within a clone – clonal degeneration – achievements – comparison among clones, pure lines and inbreds.

Unit IV: Special breeding methods

Wide hybridization – history – objectives – barriers to the production of distant hybrids – techniques for production of distant hybrids – applications of wide hybridization in crop improvement – sterility in distant hybrids – Polyploidy breeding – classification - applications in crop improvement and limitations. Mutation breeding – spontaneous and induced mutations – characteristic features of mutations – procedure of mutation breeding – applications –advantages, limitations and achievements. Breeding for resistance to biotic stresses – diseaseresistance – mechanisms of disease resistance in plants – Insect resistance – mechanism of insect resistance in plants – nature of insect resistance – genetics of insect resistance – horizontal and vertical – genetics of resistance – sources of insect resistance – breeding methods for insect resistance – problems in breeding for insect resistance – achievements. Breeding for resistance to abiotic stresses – drought resistance – mechanisms of drought resistance – features associated with drought resistance – sources – breeding methods – limitations – achievements ; breeding for resistance to water logging – effects of water logging mechanism of toleance – ideotype for flooded areas – breeding methods – breeding for salt tolerance – response of plants to

salinity – symptoms – mechanisms – breading methods – problems – achievements; cold tolerance – chilling resistance – effects of chilling stress of plants – mechanism – sources – selection criteria – freezing resistance – effects of freezing – mechanism if freezing resistance – genetic resources freezing tolerance – selection criteria – problems in breeding for freezing tolerance.

Unit V: Molecular markers and plant breeders rights

Molecular markers – Definition – Brief description of different types of molecular markers, RFLP, AFLP, RAPD and SSR markers – Importance, procedure and applications. DNA finger printing – procedure, application – QTL mapping and MAS and its applications in crop improvement. Pre breeding – Definition, Concept, need, methods and factors affecting pre breeding. Participatory Plant Breeding – Concept Relevance, activities and goals of PPB,

kinds of PPB, perspectives and prospects, advantages, disadvantages and limitations. Intellectual Property Rights (IRP) and Patents – Types, protection of IPR, trade secret, copy rights, Plant Variety Protection and Geographical Indications, Plant Breeders' Rights – Benefits and disadvantages. Protection of Plant Varieties and Farmers' Rights Act – Introduction, types f varieties, NDUS, salient features, National Gene Fund, Award and Recognitions.

Practicals

Plant Breeder's kit for hybridization, study of germplasm of various crops. Study of megasporogenesis and Microsporogenesis, fertilization and life cycle of an angiospermicplant. – Study of floral structure of self pollinated crops – floral biology, antheis, pollination, selfing and crossing techniques in rice. – Study of floral structure of cross pollinated crops – Floral biology, anthesis, pollination, selfing and crossing techniques in millets – Maize, sorghum and pearl millet. – Floral biology, anthesis, pollination, selfing and crossing techniques in oilseeds and pulses – sunflower and redgram. – Types of male sterility –genetic, Cytoplasmic and cytoplasmic Genetic male sterility, transfer of male sterile cytoplasm and restorer gene to a normal strain. – types of self incompatibility, gametophytic and sporophytic incompatibility. – Terminology in backcross method, transfer of a dominant gene and recessive gene for disease rust resistance through the backcross methods in self pollinated crops. – Handling of segregating populations – Pedigree, bulk and Single seed decent methods. – consequences of inbreeding on genetic structure of resulting populations – Types of recurrent selection, simple RS, RS for GCA & SCA and reciprocal recurrent selection. – Field layout of experiments – Designs used in plant breeding experiments – analysis of Randomized Block Design (RBD) – field trails – maintenance of records and registers. – Basic statistics, commonly used in plant breeding – Mean, range, variance,Phenotypic coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV),Heritability and Genetic advance. – Estimation of Heterosis, Heterobeltiosis and Standard heterosis – Prediction of performance of double cross hybrids.- Estimation of general combining ability, specific combining ability, variances and effects. – visit to RARS / Local / ICAR stations to acquaint about the mode of pollination in a given crop and extent of natural out crossing. – Visit to RARS / Local / ICAR Institute to acquaint about the handling of segregating generations – Pedigree, bulk and back cross methods – Preliminary Yield Trail, Advanced Varietal Trail and other methods.

Lesson plan

Theory lecture schedule

1. Plant Breeding – definition, concept, Nature, Aims & Objectives and Role. Major Achievements and future Prospects of Plant Breeding.
2. History and Development of Plant Breeding – Scientific contributions of eminent scientists – landmarks in Plant Breeding.
3. Genetics in relation to Plant Breeding – Modes of reproduction – Asexual reproduction (Vegetative reproduction and apomixes) and sexual reproduction – their classification andsignificance in plant breeding – Modes of pollination – classification of crop species on thebasis of mode of pollination – self pollination – Mechanisms promoting self and cross pollination.
4. Self incompatibility – classification – heteromorphic, homomorphic, gametophytic and

sporophytic systems of incompatibility – mechanisms of self incompatibility – Relevanceof self incompatibility – methods of overcome self incompatibility – advantages and disadvantages – utilization in crop improvement.

5. Male sterility – different types – genetic, cytoplasmic and cytoplasmic genetic male sterility – inheritance and maintenance – Utilization of male sterile lines in hybrid seed production – their limitations, advantages and disadvantages.
6. Genetic consequences of self pollination, cross pollination and often cross pollinated crops. Cultivar options – method of plant breeding – classification of plant breedingmethods – methods of breeding for self pollinated, cross pollinated and asexually propagated species – brief account of breeding methods.
7. Plant introduction – Types, history, purpose, procedure, merits and demerits – plantintroduction agencies in India – NBPGR and its activities – germplasm collections, genetic erosion, gene sanctuaries – centers of origin / diversity.
8. Biometrical genetics – definition, qualitative and quantitative characters, role ofenvironment on quantitative characters – biometrical techniques used in plant breeding – components of genetic variation – additive, dominance and epistatic variance – differences between additive and dominance variance.
9. Selection – natural and artificial selection – basic principles of selection – basic characteristies and requirements of selection – selection intensity – selection differential –heritability – genetic advance.
10. Genetic basis and breeding methods in self pollinated crops – Mass selection – procedurefor evolving a variety by mass selection – modification of mass selection – merits, demerits and achievements.
11. Genetic basis of pure line selection – general procedure for evolving a variety by pure lineselection – merits, demerits and achievements – comparison between mass and pure line selection – Johannsen's pure line theory and its concepts and significance – origin of ariation in pure lines – characters of pure lines – progeny test.
12. Hybridization – aims and objectives – types of hybridization – pre-requisites of hybridization – procedure / steps involved in hybridization.
13. Handling of segregating generation – pedigree method – procedure – modifications of pedigree method – merits, demerits and achievements.
14. Handling of segregating generations - - bulk method – procedure – merits, demerits and achievements of bulk methods – comparison between pedigree and bulk methods bulk method – procedure – merits, demerits and achievements of bulk method – comparison between pedigree and bulk method – single seed descent method.
15. Back cross method – requirements and applications, procedure for transfer of single dominant gene, recessive gene – transfer of two or more characters.
16. Back cross method – merits, demerits and achievements, comparison between pedigree and back cross methods – Multiline variety – definition, characteristics, development of multiline varieties and achievements.
17. **Mid semester examination**
18. Population genetics – concepts, Hardy Weinberg law, factors affecting equilibrium frequencies in random mating populations.
19. Heterosis – heterosis and hybrid vigour, luxuriance, brief history in self and cross pollinated crops, types, manifestations of heterosis, genetic basis – dominance, over dominance and epistasis hypotheses.
20. Heterosis – comparison between dominance and over dominance hypothesis – physiological bases of heterosis – commercial utilization of heterosis in different crops.
21. Inbreeding depression – brief history, effects of inbreeding depression, degrees of inbreeding depression – procedure for development of inbred lines and their evaluation Composites and Synthetics – production procedures, merits and demerits, achievements,

factors determining the performance of synthetics, comparison between synthetics and composites.

22. Population improvement – selection without progeny testing – selection with progeny testing – progeny selection – merits and demerits of progeny selection – line breeding – achievements – Recurrent selection – different types – detailed procedure of simple recurrent selection and brief description of other recurrent selection methods – conclusionof the efficiency of different selection schemes.
23. Methods of breeding for vegetatively propagated crops – clone – characteristics of asexually propagated crops – characteristics of clones – importance of a clone – sources of clonal selection – procedure – advantages and disadvantages – problems in breeding asexually propatated crops - genetic variation within a clone – clonal degeneration – achievements – comparison among clones, purelines and inbreds.
24. Wide hybridization – history – objectives – barriers to the production of distant hybrids – techniques for production of distant hybrids – applications of wide hybridization in crop improvement – sterility in distant hybrids – cytogenetic, genetic and cytoplasmic bases of sterility – limitations and achievements.
25. Polyploidy – autopolyploids – origin and production – morphological and cytological features of autopolyploids – applications of autopolyploidy in crop improvement – limitations of autopolyploidy – segregating in autotetraploids – allopolyploidy – morphological and cytological features of allopolyploids – applications of allopolyploidy in crop improvement – limitations of allopolyploidy.
26. Mutation breeding – spontaneous and induced mutations – characteristic features of mutations – procedure of mutation breeding – applications – advantages, limitations and achievements.
27. Breeding for resistance to biotic stresses – disease resistance – mechanisms of disease resistance in plants disease escape, tolerance, resistance, immunity and hypersensitivity)
    – causes of disease resistance – genetic basis of disease resistance – sources of diseaseresistance – breeding methods for disease resistance – achievements – Insect resistance
    – mechanism of insect resistance in plants (non preference, antibiosis, tolerance and avoidance) – nature of insect resistance – genetics of insect resistance – horizontal and vertical – genetics of resistance – sources of insect resistance – breeding methods for insect resistance – problems in breeding for insect resistance – achievements.
28. Breeding for resistance to abiotic stresses – drought resistance – mechanisms of drought resistance (drought escape, avoidance, tolerance, and resistance) – features associated with drought resistance – sources – breeding methods – limitations – achievements; breeding for resistance to water logging – effects of water logging mechanism of tolerance
    – ideotype for flooded areas – breeding methods – breeding for salt tolerance – response of plants to salinity – symptoms – mechanisms – breeding methods – problems – achievements; cold tolerance – chilling resistance – effects of chilling stress of plants – mechanism – sources – selection criteria – freezing resistance – effects of freezing – mechanism of freezing resistance – genetic resources for freezing tolerance – selection criteria – problems in breeding for freezing tolerance.
29. Molecular markers – Definition – Brief description of different types of molecular markers, RFLP, AFLP, RAPD and SSR markers – Importance, procedure and applications.
30. DNA finger printing – procedure, application – QTL mapping and MAS and its applicationsin crop improvement.
31. Pre breeding – Definition, Concept, need, methods and factors affecting pre breeding. Participatory Plant Breeding – Concept Relevance, activities and goals of PPB, kinds of PPB, perspectives and prospects, advantages, disadvantages and limitations.
32. Intellectual Property Rights (IRP) and Patents – Types, protection of IPR, trade secret,copy rights,
33. Plant Variety Protection and Geographical Indications
34. Plant Breeders' Rights – Benefits and disadvantages.

Practical schedule

1. Plant Breeder's kit for hybridization, study of germplasm of various crops.
2. Study of megasporogenesis and Microsporogenesis, fertilization and life cycle of anangiospermic plant.
3. Study of floral structure of self pollinated crops – floral biology, antheis, pollination, selfingand crossing techniques in rice.
4. Study of floral structure of cross pollinated crops - Floral biology, anthesis, pollination,selfing and crossing techniques in millets – Maize, sorghum and pearl millet.
5. Floral biology, anthesis, pollination, selfing and crossing techniques in oilseeds andpulses – sunflower and redgram.
6. Types of male sterility – genetic, Cytoplasmic and cytoplasmic Genetic male sterility, transfer of male sterile cytoplasm and restorer gene to a normal strain.
7. Types of self incompatibility, gametophytic and sporophytic incompatibility.
8. Terminology in backcross method, transfer of a dominant gene and recessive gene fordisease rust resistance through the backcross methods in self pollinated crops.
9. Handling of segregating populations – Pedigree, bulk and Single seed decent methods.
10. Consequences of inbreeding on genetic structure of resulting populations – Types of recurrent selection, simple RS, RS for GCA & SCA and reciprocal recurrent selection.
11. Field layout of experiments – Designs used in plant breeding experiments – analysis of Randomized Block Design (RBD) – field trails – maintenance of records and registers.
12. Basic statistics, commonly used in plant breeding – Mean, range, variance, Phenotypic coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV), Heritability and Genetic advance.
13. Estimation of Heterosis, Heterobeltiosis and Standard heterosis – Prediction ofperformance of double cross hybrids.
14. Estimation of general combining ability, specific combining ability, variances and effects.
15. Visit to RARS / Local / ICAR stations to acquaint about the mode of pollination in a given crop and extent of natural out crossing.
16. Visit to RARS / Local / ICAR Institute to acquaint about the handling of segregating generations – Pedigree, bulk and back cross methods – Preliminary Yield Trail, AdvancedVarietal Trail and other methods.
17. **Final practical examination**

Course outcome:

CO 1: The student will have the gist of the various self and cross pollinated crops.

C**O 2:** Will be able to develop expertise in the various crossing and emasculation techniquesin various crops

CO 3: Students will develop the capacity to carry out independent plant breeding experiments

CO 4: The students will be able to multiply and modify the vegetatively propagated crops.

CO 5: The students will be able to develop in the various biotic and abiotic resistance sourcein various crops.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	3			3	
CO2	3				3
CO3					3
CO4					3
CO5		3			2

References

1. Singh, B.D. 2006. Plant breeding - Principles and methods. Kalyani Publishers, NewDelhi.
2. Allard, R. 1960. Principles of Plant breeding. John Wiley and Sons, New York.
3. Chopra, V.L., 1994. Plant Breeding Theory and Practice. Oxford and IBH PublishingCo.Pvt. Ltd.
4. Phundan Singh, 2006. Essentials of Plant Breeding. Kalyani Publishers, New Delhi.
5. Sharma, J.R. 1994. Principles and Practice of Plant Breeding. Tata McGraw HillPublishing Company Ltd., New Delhi.

e- resources

1. http://eagri.org/eagri50/GBPR211/index.html
2. https://www.rvskvv.net/images/II-Year-II-Sem_Principles_Plant-Breeding_ANGRAU_20.04.2020.pdf
3. https://www.rvskvv.net/images/II-Year-II-Sem_Principles_Plant-Breeding_YNAU_20.04.2020.pdf
4. http://ecoursesonline.iasri.res.in/course/view.php?id=134
5. https://ecourses.icar.gov.in/e-Leaarningdownload3_new.aspx?Degree_Id=01

23 AGM 201 PRINCIPLES OF FOOD SCIENCE AND NUTRITION (1+1)

Learning objectives:

- The impart knowledge on microbes and their diversity, sources of contamination in food.
- To make the students to know the principle underlying food preparation and preservation technologies.
- To have a knowledge on the fermentation technologies of producing value-added foodsby microbes and their spoilage.
- To impart knowledge on nutritive value on foods, spoilage and develop skills andtechniques on pasteurization and preservation methods.
- To learn advanced techniques on food production, processing, packing and qualitycontrol.

Theory

Unit I: Introduction to Food and Microflora

Food in relation to health – food groups – incidence and behavior of microorganism in food – source of contamination in food.

Unit II: Nutritive Value and Preservation

Composition and nutritive value – rice, wheat, bajra, ragi, raw rice, groundnut, black gram – breakfast cereal – idly - chapathi and cakes. Principles and method of food preservation – physical method – high temperature, low temperature, drying, osmotic pressure, irradiation, chemical method – class I and class II chemical, other adulterants.

Unit III: Fermented Food and Spoilage

Fermentation of pickles, sauerkraut, bread, vinegar, idly. Single cell proteins – microbialspoilage of different types of food – cereals, fruits and vegetables, meat and sea foods.

Unit IV: Milk, Egg, Fats and Oils

Milk – composition – nutritive value, spoilage, pasteurization. Egg – structures, composition, nutritive value, spoilage. Fats and oils – composition, emulsion, rancidity, smoking point, roleof fat/oil in cookery.

Unit V: Novel Food Production, Processing, Packing and Quality Control

Mushroom, spirulina, leaf protein concentrates (LPC), packaging material, package forms, andtechniques Aseptic packaging, referable containers, modified and control atmosphere packaging, microwaveable containers, other package forms. Food manufacturing practice, quality control, Food safety Laws and standards.

Lesson plan

Theory schedule

1. Food in relation to health – food groups.
2. Incidence and behaviors of microorganisms in food and Sources of microorganisms infood.
3. Intrinsic and extrinsic parameters of food affecting microbial growth.
4. Composition and nutrient value of rice, wheat, bajra, raw rice, ragi, peanut and blackgram.
5. Breakfast cereal – idly, chapathi, cake.
6. Food preservation techniques adulterants.
7. Fermentation of pickles, sauerkraut, bread, vinegar, idly.
8. **Mid semester examination**
9. Single cell protein production techniques.
10. Microbial spoilage of cereals fruits and vegetables.
11. Spoilage of fresh foods.
12. Nutritive value of milk, spoilage and pasteurization technique.
13. Structure, composition, nutritive value of egg.
14. Fats and oils – composition, emulsion, rancidity, smoking point.
15. Novel food production and processing of mushroom, spirulina and leaf proteinconcentration.
16. Types of packaging materials
17. Food manufacturing practices, quality control, Food safety Laws and standards.

Practical schedule

1. Microbiological examination of fruits.
2. Microbiological examination of vegetables.
3. Microbiological examination of cereals.
4. Spoilage of bakery foods.
5. Microbiological examination of seafoods.
6. Microbiological examination of egg.
7. Direct microscopic counting bacteria in liquid foods.
8. Examination of canned foods for sterility and quality.
9. Production of fermented foods – Sauerkraut.
10. Isolation and enumeration of yeast from rice batter.
11. Isolation of lactic acid bacteria from curd.
12. Methylene blue reduction test.
13. Resazurin test.
14. Production of single cell protein
15. Production of leaf protein concentrates.
16. Microbiological spoilage of pulses.
17. **Practical examination**

Course outcome

CO 1 - The students would thoroughly understand about the nutritional properties.
CO 2 - The students exposed to food microbes and awareness in wellbeing.
CO 3 - To have a knowledge on the fermentation technologies of producing value-addedfoods by microbes and their spoilage.

CO 4 - The students would expose to the principles involving the food preservation.
CO 5 - The students will gain knowledge on the role of microorganism in food and processing techniques.

CO – PO MAPPING MATRIX

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	-	-	-	-	-
CO 2	-	2	-	-	-	-
CO 3	-	2	-	-	-	-

CO 4	-	-	-	-	**2**	-
CO 5	-	-	-	-	-	**3**

Current stream of thoughts

1. Basic knowledge on nutritive value of foods
2. Knowledge on microbes and their contamination in foods
3. Microbial spoilage of various foods
4. Gain knowledge on Preservation techniques
5. To know the food production, processing, packing and quality control

References

1. Srilakshmi, B. 2002. FOOD SCIENCE. New age, international (P) limited, publisher, newDelhi, second edition.
2. Vijaya khader. 2001. Text book of Food Science and Technoology. Directorate ofinformation and publications of agriculture, ICAR, New Delhi.
3. Bibek Ray. 2004. Fundamentals of Food Microbiology. CRC Press, New York
4. Adams, M. R. 2008. Food Microbiology (3rd edition), Panima Publishing Corporation, NewDelhi
5. Frazier, W.C. 2008. Food Microbiology, 4th Edition, Tata Mc Graw Hill, New Delhi

e-resources

1. https://www.emeraldgrouppublishing.com/journal/nfs
2. https://siter:google.com/a/used.in/ecourse/food-science-and nutrition
3. https://www.journals.elsevier.com/food-microbiology
4. https://www.nature.com/subjects/food-microbiology
5. https://www.nature.com/subjects/food-microbiology

23 HOR 201 PRODUCTION TECHNOLOGY FOR VEGETABLES, SPICES AND PROTECTEDCULTIVATION (2+1)

Learning objectives

- To learn about the nursery practices, planting methods of vegetable crops.
- To learn about the cultivation techniques, maturity indices, harvesting techniques ofvegetable crops.
- To learn about the nursery practices, propagation methods of spice crops.
- To learn about the cultivation techniques, harvesting techniques of spice crops.
- To provide knowledge on protected cultivation of vegetable crops.

Theory

Unit I: Importance of vegetables, spices and cultivation details of solaneous vegetables Importance of vegetables in human nutrition and role of spices in national economy - origin, area, climate, soil, improved varieties and cultivation practices viz., time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of following crops:

Tomato, brinjal, chilli, potato and onion.

Unit II: Cucurbits, legumes, perennial and leafy vegetables

Cucumber, watermelons, pumpkin, ash gourd, snake gourd, bitter gourd, bottle gourd, ridge gourd, garden bean, cluster bean, french bean, peas, annual moringa, chow chow andamaranthus

Unit III: Cole crops, roots, tubers and yam

Cabbage, cauliflower, knol-khol, carrot, beetroot, radish, tapioca, sweet potato, elephant foot yam.

Unit IV: Major spice crops

Pepper, cardamom, clove, turmeric, and ginger.

Unit V: Protected cultivation

Green house technology –scope and importance - types of greenhouses - Plant response to Greenhouse environment- structural components of a greenhouse-protected cultivation ofcapsicum and cucumber.

Current stream of thoughts.

Practical

Identification of vegetables & spice crops and their seeds. Nursery raising. Direct seed sowing and transplanting. Study of morphological characters of different vegetables & spices. Fertilizers applications. Harvesting & preparation for market.

Economics of vegetables and spices cultivation- Study on different modes of protected cultivation-Study on structural components of a greenhouse

Lesson plan

Theory Schedule

1. Importance of vegetables in human nutrition
2. Role of spices in national economy
3. Production technology of Tomato
4. Production technology of Brinjal
5. Production technology of Chilli
6. Production technology of Potato
7. Production technology of Onion
8. Production technology of Cucumber and Watermelons.
9. Production technology of Pumpkin and Ash gourd.
10. Production technology of Snake gourd and Bitter gourd,
11. Production technology of Bottle gourd and Ridge gourd
12. Production technology of Garden bean and Cluster bean.
13. Production technology of French bean and Peas
14. Production technology of Annual moringa
15. Production technology of Chow chow
16. Production technology of Amaranthus
17. **Mid-Semester Examinations**
18. Production technology of Cabbage
19. Production technology of Cauliflower
20. Production technology of Knol-khol
21. Production technology of Carrot
22. Production technology of Beetroot and Radish
23. Production technology of Tapioca
24. Production technology of Sweet potato and Elephant foot yam
25. Production technology of Pepper
26. Production technology of Cardamom
27. Production technology of Clove
28. Production technology of Ginger
29. Production technology of Turmeric
30. Scope and importance of protected cultivation
31. Types of greenhouses
32. Plant response to Greenhouse environment
33. Production technology of Capsicum under protected condition
34. Production technology of Cucumber under protected condition

Practical Schedule

1. Identification of vegetables & spice crops.
2. Identification and study on seed viability of different vegetable crops.
3. Calculation of seed requirement for important vegetable crops.
4. Raising vegetable seedlings in nursery bed and protrays.
5. Transplanting methods of vegetable crops.

6. Study of morphological characters of different vegetables & spices.
7. Study on water management techniques for vegetable crops.
8. Study on fertilizers applications in vegetable crops.
9. Study on maturity indices of vegetable crops.
10. Study on physiological disorders of vegetable crops
11. Study about grading and packaging of vegetable crops.
12. Calculating cost of production of important vegetable crops
13. Harvesting methods for spice crops
14. Processing methods of spice crops
15. Study on different modes of protected cultivation.
16. Study on structural components of a greenhouse.
17. **Final Practical examination.**

Course outcome

CO 1: The students will be able to practice the nursery techniques and planting methods ofvegetable crops

CO 2: The students will be able to understand the cultivation techniques of vegetable crops.CO3: The students will be to diagnose problems in cultivation of vegetable crops.

CO4: The students will be able to practice the protected cultivation of vegetable cropsCO5: The students will be able to practice production techniques of spice crops

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	3	3	3	3	1	0
CO 5	3	3	2	3	3	0

References

1. Shanmugavelu, K.G. 1989. Production Technology of Vegetable Crops. Oxford India Publication, New Delhi.
2. Singh, S.P. 1989. Production Technology of Vegetable Crops. Universal Publicationcentre, Karnal.
3. Veeraraghavathatham, D., M. Jawaharlal and SeemanthiniRamadas. 1996. A Guideon Vegetable Culture. A.E. Publications, Coimbatore
4. Thamburaj. S. and N.Singh 2004. Vegetables, Tuber Crops and Spices. ICAR. VishnuSwarup, 2006. Vegetable science and technology in India. Kalyani publishers, New Delhi.
5. Balraj Singh. 2005. Protected cultivation of vegetable crops. Kalyani Publishers,Ludhiana.

e–references

1. http://www.informaworld.com/smpp/title~db=all~content=g904622674
2. http://www.ces.ncsu.edu/depts/hort/hil/hil-32-a.html
3. http://attra.ncat.org/attra-pub/manures.html
4. http://ucanr.org/freepubs/docs/8129.pdf
5. http://www.sus-veg-thai.de/

23 AEC 201 FARM MANAGEMENT, PRODUCTION AND RESOURCE ECONOMICS(1+1)

Learning objectives

- To provide knowledge to the students about the principles of farm management
- To help the students in using different methods and tools for decision making in farm management
- To explain ways for profit maximization through optimizing resource use
- To know the risk and uncertainty in production
- To understand the common property resources

Theory

Unit I: Production Economics and Farm Management - Nature and Scope

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms. Types of farming: Specialized, Diversified, and Mixed farming – Systems of farming: Peasant Farming, State Farming, Capitalistic, Collective and Co – operative Farming.

Unit II: Factor – Product, Factor – Factor and Product – Product Relationships

Principles of farm management: concept of production function and its characteristics and its type, use of production function in decision-making on a farm. Factor-Product relationship. meaning, Definition – Laws of Returns. Meaning and concept of cost, types of costs, cost curves - and their inter-relationship - shut down and break-even points, importanceof cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Economies of Scale – Economies of Size -Determination of Optimum Input and Output – Physical and Economic Optimum. Factor –Factor relationship: Least Cost Combination of inputs; Product – Product relationship: Optimum Combination of Products – Principle of Equi – Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.

Unit III: Farm Planning and Budgeting

Farm business analysis: meaning and concept of farm income and profitability, technical andeconomic efficiency measures in crop and livestock enterprises. Importance of farm recordsand accounts in managing a farm, various types of farm records needed to maintain on farm,farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farmplanning and budgeting, partial and complete budgeting, steps in farm planning and budgeting -linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

Unit IV: Risk and Uncertainty in Agriculture Production

Concept of risk and uncertainty occurrences in agriculture production, nature and sources of risks and their management strategies**,** Crop / livestock / machinery insurance. Weather based crop insurance - Features and determinants of compensations.

Unit V: Resource Economics

Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources. Natural Resources - Issues – Scarcity of resources – Factors mitigating scarcity – PropertyRights: Common Property Resources (CPRs): meaning and characteristics of CPRs – Externalities:meaning and types - positive and negative externalities in agriculture, Inefficiency

and welfare loss, solutions; Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practicals

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns / opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use ina farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crops – Estimation of costs and returns of livestock products. Preparation of farm plan and budget, farm records and accounts and profit and loss accounts. Break – even analysis- Graphical solution to Linear Programming problem. Collection and analysis of data on various resources in India.

Lesson plan

Theory Schedule

1. Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factors determining types and size of farms – Objectives of farm management – Production Economics Vs FarmManagement.
2. Types of farming: Specialized, Diversified, and Mixed farming – Systems of farming: Peasant
Farming, State Farming, Capitalistic, Collective and Co – operative Farming.
3. Principles of farm management: Factor – Product relationship: Meaning, Definition – Laws of Returns: Concept of production function, Classical production function and three stages of production and its characteristics – types of production function and use of production function in decision making.
4. Meaning and concept of cost, types of costs, cost curves - and their inter-relationship -shut down and break even points, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labour income and farm business income.
5. Economies of Scale – Economies of Size - Determination of Optimum Input and Output – Physical and Economic Optimum.
6. Factor – Factor relationship: Meaning – Isoquant – definition and types – isoquant map – MRTS – Isocost line - Least Cost Combination of inputs – expansion path – isocline – ridge line – Elasticity of Factor Substitution.
7. Product – Product relationship: Meaning – Production Possibility Curve – MRPT – Enterprise
relationship: Joint products, complementary, supplementary and competitive products – Iso revenue line - Optimum Combination of Products.
8. Principle of Equi –Marginal Returns – Principle of Opportunity Cost and Minimum Loss Principle. Law of Comparative Advantage.
9. Mid Semester Examination.
10. Farm business analysis: meaning and concept of farm income and profitability, technical and
economic efficiency measures in crop and livestock enterprises.
11. Importance of farm records and accounts in managing a farm, various types of farm records

needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts.
12. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting – Concept of risk and uncertainty in agriculture production, nature and sources of risks and its management strategies.
13. Linear programming, appraisal of farm resources, selection of crop and livestock enterprises.
14. Crop / livestock / machinery insurance. Weather based crop insurance - Features and determinants of compensations.
15. Resource Economics: Concepts, Classification, differences between Natural Resource Economics (NRE) and agricultural economics, unique properties of natural resources.
16. Natural Resources Issues – Scarcity of resources – Factors mitigating scarcity – Property Rights – Common Property Resources (CPRs): meaning and characteristics of CPRs –Externalities: meaning and types - positive and negative externalities in agriculture –Inefficiency and welfare loss, solutions.
17. Important issues in economics and management of common property resources of land, water, pasture and forest resources.

Practical schedule

1. Preparation of farm layout. Determination of cost of fencing of a farm.
2. Computation of depreciation of farm assets. Cost of farm assets: Valuation of assets by different methods.
3. Application of equi - marginal returns / opportunity cost principle in allocation of farm resources.
4. Determination of most profitable level of inputs use in a farm production process.
5. Determination of least cost combination of inputs.
6. Selection of most profitable enterprise combination.
7. Application of cost principles including CACP concepts in the estimation of cost of cultivationand cost of production of agricultural crops.
8. Estimation of cost of cultivation and cost of production of perennial crops / horticultural crops.
9. Estimation of cost of returns of livestock products.
10. Preparation of farm plan and budget.
11. Farm records and accounts: Usefulness, types of farm records: farm production records and farm financial records.
12. Preparation of Cash flow statement
13. Preparation and Analysis of Net worth Statement and Profit and Loss statement
14. Estimation of Break – even analysis.
15. Graphical solution to Linear Programming problem.
16. Collection and analysis of data on various resources in India.- Land use pattern, Agro climatic zones etc
17. **Final Practical Examination.**

Course outcome

CO1: Understand the concepts, nature and Scope of farm management
CO2: Know the importance of farm planning and budgeting.
CO3: Work out the cost of cultivation for different crops

CO4: Importance of farm records and accounts and farm business analysis
CO5: Understand the natural resources issues and CPR

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	-	-	-	-
CO2	3	-	-	-	-	-
CO3	-	2	3	-	-	-
CO4	-	-	-	-	-	2
CO5	1	-	2	-	-	-

References

1.Doll,J.P.andF.Orazem,1983. Theory of Production Economics with Applications to Agriculture, John Wiley,NewYork.

2. Johl,S.S. and Kapoor,T.R., 2000. Fundamentals of Farm Business Management, Kalyani Publications, India.

3. Panda, S.C., 2007. Farm Management and Agricultural Marketing, Kalyani Publications, Ludhiana, India.

4. Raju,V.T.and Rao, D.V.S., 2000.Economics of Farm Production and Management,Oxford and IBH Publishing Co.Pvt.Ltd.,NewDelhi.

5. Kahlon, A.S and Singh K. 1992. Economics of Farm Management in India. AlliedPublishers. New Delhi.

e-references

1.https://www.rvskvv.net/images/III-Year-II-Sem_Farm-Managment--Production-Economics_ANGRAU_24.04.2020.pdf
2.https://agrimoon.com/wp-content/uploads/Production-Economics-Farm-Management.pdf
3.http://hillagric.ac.in/edu/coa/agriecoextedursocio/lectures/AgEcon122FSM.pdf
4.https://agrigyan.in/agecon-321-farm-management-production-resourse-economics-notes-pdf/
5. http://eagri.org/eagri50/AECO342/index.html

23 AHS 201 LIVESTOCK MANAGEMENT (1+1)

Learning Objectives

- The course aims to impart knowledge and adequate understanding of the importance ofthe Dairy Industry in the National economy and in different career Opportunities
- To familiarize with different livestock breeds in relation to various agro climatic zones, enabling to choose appropriate breeds for their utility

- To provide hands-on and field oriented training in dairy cattle management techniquesthat will assist students to develop entrepreneurial skills.
- To disseminate information on scientific feeding using locally available feed componentsin order to save the farming expenditure
- To signify the importance of clean milk production and different milking methods

Theory

Unit I: Introduction to Livestock Management

Introduction - Significance of Livestock in Indian economy- census - common nomenclatures used in white and black cattle - various systems of livestock rearing - Extensive, intensive, semi-intensive and integrated

Unit II: General Cattle Management

Breeds - classification of breeds - Breeds of white and Black cattle - Jersey, HF, Gir, Sindhi, Sahiwal, Kangeyam, Murrah, Surti and Toda - Care and management of new born calf,heifers, pregnant and lactating animals - wallowing – culling

Unit III: Reproductive and Housing Management of Dairy cattle

Breeding - Estrous cycle - Signs of estrum - Silent heat - Artificial insemination - Housing - selection of site - systems - loose housing - conventional barns - single row and double row - floor space requirement

Unit IV: Feeding and General Health Management of Dairy cattle

Nutrition - Ration - balanced ration - concentrate - roughage - classification of feed and fodder - Distribution of total dry matter requirement - Green fodder and its importance - General disease control measures - signs of health - Deworming and Vaccination

Unit V: Milk and Milk Processing

Milk - Composition - Milking methods - Clean milk production - Pasteurization of Milk and Current stream of thoughts.

Practicals

Study of external parts of cattle-Identification methods - Restraining -Disbudding -Deworming -Ageing - Design of cattle shed-Selection of Dairy cow - Specific gravity of milk- Fat percentageof milk- Artificial Insemination- Weight of cattle-Cream separation-Feeds and fodder-Milking methods.

Lesson Plan

Theory Schedule

1. Introduction to Livestock and its significance in Indian economy
2. Common nomenclatures used in dairy cattle
3. Systems of dairy cattle rearing practices
4. Classification of different breeds of white and black cattle with examples
5. Care and Management of new born cattle
6. Care and Management of heifers, pregnant and lactating animals - wallowing- culling
7. Estrous cycle- signs of estrum - silent heat
8. AI - merits, demerits and procedure
9. **Mid-Semester Examination**
10. Housing management- selection of site- floor space requirement
11. Systems of housing
12. Nutrition- Classification of feeds and fodder - Ration and balanced ration
13. Importance of green fodder
14. General health Management- Deworming and Vaccination
15. Milk - Composition- Milking Methods
16. Clean milk production
17. Pasteurization of milk and Current stream of thoughts.

Practical Schedule

1. Study of external parts of cattle
2. Identification methods of Cattle and Buffalo
3. Common methods of restraining in cattle and Buffalo
4. Disbudding in calves
5. Deworming in cattle and Buffalo
6. Ageing in cattle
7. Design of cattle shed
8. Selection of Dairy cow by unified score card method
9. Determination of specific gravity in milk
10. Determination of fat percentage in milk
11. Demonstration of AI
12. Determination of weight in cattle
13. Demonstration of cream separation
14. Identification of feeds and fodder
15. Demonstration of milking methods
16. Visit to Dairy farm
17. **Practical Examination**

Course Outcome

CO 1: The students gain knowledge in basic concepts of scientific rearing of cattle.

CO 2: Further, they would enrich on cattle management practices including feeding, breeding and housing.

CO 3: Students would be able to analyse and solve different problems arising in cattle andgoat rearing.

CO 4: This course encompasses all relevant information and serve as source of knowledge to understand the modern techniques used in animal husbandry sector.

CO 5: It enlightens the importance of livestock products and clean milk production.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	**3**	**-**	**2**	**1**	**3**	**-**
CO 2	**3**	**-**	**2**	**-**	**3**	**1**
CO 3	**3**	**-**	**3**	**1**	**1**	**1**
CO 4	**3**	**-**	**3**	**-**	**2**	**2**
CO 5	**2**	**-**	**1**	**2**	**2**	**1**

References

1. Banerjee G.C., 2010. The Text book of Animal Husbandry, Oxford and IBH Publishing Company Pvt.Ltd, New Delhi.
2. Gautam .V..N. and Shraddha Shrivastava, 2017. A Text book of Livestock Production and Management, Aavishkar Publishers, Chaura Rasta Jaipur.
3. Gopalakrishnan C.A and Lal, DMM., 1992. Livestock and Poultry Enterprises for Rural Development,Vikas Publishing House Private Limited , New Delhi-44.
4. Gupta P.R.,Dairy India Yearbook, 2007. A-25, Priyardarshini Vihar, New Delhi.
5. Sastry, N.S.R and C.K. Thomas, 2021. Livestock Production Management, Sixth edition,Kalyani Publishers, Darya Ganj, New Delhi-2.

e-resources

1. https://agritech.tnau.ac.in/animal_husbandry/animhus_cattle%20_index_page.html
2. https://elewa.org/animalmanagement/Dairycattlemanagement.pdf
3. http://www.jnkvv.org/PDF/17042020095551Livestock-Production-and-Management%20(4%20files%20merged)_compressed.pdf

4. https://icar.org.in/files/reports/icar-dare-annual-reports/2009-10/Livestock-Managementt.pdf
5. http://lms.tanuvas.ac.in/course/view.php?id=19

23 AEG - 201 INTRODUCTORY SOIL AND WATER CONSERVATION ENGINEERING 2(1+1)

Learning objectives

To impart the basics of soil and water conservation engineering to the undergraduate students.

Theory

Unit I: Surveying and Levelling

Surveying and levelling – Chain, compass and plane table survey – levelling – land measurement and computation of area – Simpson's rule and Trapezoidal rule. Height of instrument, Bench mark, Contour survey-definition, characteristics

Unit II: Irrigation and drainage

Irrigation – measurement of flow in open channels – velocity area method – rectangular weir – Cippoletti weir – V notch – orifices – Parshall flume – duty of water – irrigation efficiencies – conveyance of irrigation water – canal lining – underground pipeline system – surface irrigation methods – borders, furrows and check basins – drip and sprinkler irrigation –agricultural drainage – surface irrigation systems – sub-surface drainage systems – drainage coefficient - design of open ditches.

Unit III: Wells and Pumps

Groundwater occurrence – aquifers – types of wells and sizes – pump types – reciprocating pumps – centrifugal pumps – turbine pumps – submersible pumps – jet pumps – airlift pumps – selection of pumps – operation and their maintenance. Current Streams of thought.

Unit IV: Soil conservation and watershed management

Erosion control measures for agricultural lands – biological measures – contour cultivation – Strip cropping - cropping systems – vegetative barriers – wind breaks and shelterbelts – shifting cultivation – mechanical measures – contour bund – graded bund – broad beds and furrows – basin listing – random tie ridging – mechanical measures for hill slopes – contour trench – bench terrace – contour stone wall – Rain water harvesting – insitu soil moisture conservation – Runoff Computation – runoff water harvesting – Farm ponds and percolation ponds – storage and its use for domestic and ground water recharge. Gully control structures – Check dams – Temporary and permanent. Watershed concept – Integrated approach and management.

Unit V: Soil erosion

Soil Erosion – causes and evil effects of soil erosion – geologic and accelerated erosion – water erosion – causes – erosivity and erodibility – mechanics of water erosion – splash, sheet, rill and gully erosion – ravines – land slides – wind erosion – factors influencing wind erosion – mechanics of wind erosion – suspension, saltation, surface creep. Water harvesting techniques

Practicals

Study of survey instruments – chains and cross staff surveying – linear measurement –plotting and finding areas. Compass survey – observation of bearings – computation of angles – radiation, intersection. Levelling – fly levels – determination of difference in elevation – Computation of area and volume – Contouring, Design of contour bund graded bund. Drip systems and Sprinkler irrigation systems. Problems on water measurement. Problems on duty of water, irrigation efficiencies. Problems on water requirement – agricultural drainage. Study of different types of wells and its selection. Study of pumps and its selection.

Lesson plan

Theory Schedule

1. Surveying – definition and objectives of survey, primary divisions of surveying, definitionof geodetic and plane surveys, linear measurements (MKS), measurement of distances.
2. Levelling-definition, description of dumpy level and Levelling staff, terminology connectedwith

Levelling. Height of instrument, Bench mark and its types, change point.

3. Contour survey-definition, characteristics and uses of contours.
4. Irrigation-definition, classification of irrigation projects based on CCA and expenditure, benefits of irrigation, ill effects of irrigation, flow irrigation and lift irrigation.
5. Earthern channels-Advantages and disadvantages of earthern channels, channel lining materials, Advantages of lining the channels. Underground pipeline over earthern channels, disadvantages.
6. Measurement of irrigation water-importance, methods of measuring water-volumetric and area-velocity method.
7. Direct discharge methods-water meter, weirs, and orifices, parshall flume-Installation of these devices, conditions for weir installation.
8. Water lifting devices-classification of pumps, centrifugal pump, principle of operation, Installation procedure.
9. **Mid Semester examination**
10. Deep well pump- submersible pumps, Installation and working principle of pump – Troubles and remedies.
11. Water conveyance systems-open channel, definitions of wetted perimeter, hydraulic radius, hydraulic slope, area of cross section and free board. Manning‘s formula.
12. Soil and water conservation-definition and scope, soil erosion-definition, types, Geologicaland accelerated soil erosion, causes and ill effects of soil erosion.
13. Accelerated soil erosion-water and wind erosion definitions, rain drop (splash) erosion, sheet erosion, rill erosion, Gully erosion, stream bank erosion and their stage of occurrence.
14. Study on soil estimation methods : USLE, MUSLE, EI and Cosecton wheel method
15. Erosion control measures-Engineering measure. Study of engineering measures likecontour bunds, graded bunds, broad based terracing and bench terracing.
16. Wind erosion definition, mechanics of wind erosion and types of soil movement.Principles of wind erosion and its controls methods
17. Water harvesting techniques: Definition and types

Practical schedule

1. Acquaintance with survey equipment
2. Acquaintance with leveling instruments and levelling procedure
3. Contour field survey
4. Preparation of contour maps using contour field survey data
5. Study of components of centrifugal pump
6. Power estimation on centrifugal pump
7. Capacity calculation of open channel
8. Discharge calculation of different water measuring devices
9. Identification of different forms of water erosion
10. Estimation of soil loss by USLE method
11. Exercise on soil erosion control by contour and graded bunds
12. Exercise on broad base and bench terracing
13. Exercise on shelterbelts and wind breaks.
14. Study on onfarm water harvesting methods
15. Visit to water harvesting structures like farm pond
16. Visit to nearby watershed to study soil conservation structures
17. **Practical Examination**

References

1. Surveying and Leveling Vol.1 by Kanetkar T P and Kulkarni S V 1981. Vidyarthi Griha
2. Praksam, Pune.
3. Land and water Management Engineering by Murthy V V N 1982, Kalyani publishers, NewDelhi.

4. Irrigation Theory and practice by Michael A M 1989. Vikas Publishing House Pvt. Ltd, NewDelhi.
5. Principles of Agricultural Engineering – Vol II. By Michael AM and Ojha TP 1993. Jain
6. Brothers, New Delhi.
7. Introduction to soil and water conservation Engineering by B.C.MAL 2005, Kalyanipublishers, New Delhi.

IIISemester

23 AGR 204 PRACTICAL CROP PRODUCTION - I (*Kharif* Crops) (0+1)

Learning objectives

Crop planning, raising field crops in multiple cropping systems. Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management. Management of insect- pests diseases of crops. Harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect- pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

- Each student will be allotted a minimum land area of 100/200 m2. He / she will do all field operations in the allotted land from field preparation to harvest and processing.
- Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying,winnowing, storage and marketing of produce.
- Rice (Transplanted or direct sown)

Transplanted rice:

- Rice ecosystems - Climate and Weather - Seasons and varieties of India and Tamil Nadu.
- Preparation of nursery - Application of manures to nursery - seed treatment - Forming nursery beds and sowing seeds – Weed and water management and plant protection to nursery.
- Preparation of main field - Application of organic manures - Green manuring - Bio-fertilizers - Pulling out seedlings and transplanting - Rajarajan 1000 (SRI) - Application of herbicides - Water management - Nutrient management - Plant protection measures - Mechanization in rice cultivation - Recording growth, yield attributes and yield.
- Harvesting, threshing, drying and cleaning the produce - Working out cost of cultivation and economics.

Practical

1. Study of rice ecosystems, climate, weather, seasons and varieties of Tamil Nadu.
2. Acquiring skills in selection of nursery area, preparation of nursery, application of manures and fertilizer to nursery.
3. Study and practice of green manuring and bio-fertilizer application in rice and acquiring skills in seed treatment, seed soaking and incubation, nursery sowing and management.
4. Study and practice of main field preparation and puddling operations
5. Practicing of field preparatory operations – sectioning of field bunds and plastering, leveling and basal application of fertilizers.
6. Practicing transplanting techniques in lowland rice/ exposure to mechanized

transplanting.

7. Estimation of plant population and acquiring skill in thinning and gap filling
8. Study of weeds and weed management in rice/ exposure to mechanized weeding
9. **Mid-semester examination**
10. Acquiring skill in nutrient management and practicing top dressing techniques
11. Study of water management practices for lowland rice
12. Observation of insect pests and diseases and their management
13. Recording growth and other related characters of rice
14. Estimation of yield and yield parameters in rice
15. Harvesting, threshing and cleaning of the produce/exposure to mechanized harvesting& threshing.
16. Preparation of balance sheet including cost of cultivation and net returns perstudent
17. **Practical examination**

Note: According to the season, the crops in practical crop production – I & IIcan be interchanged

Course Outcome

CO 1: To acquire skill in various agronomic practices that can bring improvedcropyield.
CO 2: To gain hands on experience on cultivation of crops individually.
CO 3: To understand the different sowing methods for garden land crops
CO 4: To apply different seed treatment techniques
CO 5: To evaluate different harvesting methods and processing

CO-PO Mapping

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	3
CO2	1	2	3	-	2	-
CO3	2	1	-	-	-	-
CO4	1	-	-	-	2	-
CO5	2	-	-	3	-	1

References

1. Crop Production Guide. 2020. Directorate of Agriculture, Chennai and Tamil Nadu Agricultural University, Coimbatore.
2. Rajendra Prasad. 2006. Text Book on Field Crop Production, Indian Council ofAgrl. Research,New Delhi.
3. K Annadurai and B Chandrasekaran. 2009. A Text Book of Rice Science. Scientific Publishers, Chennai
4. Reddy,S. R. 2012. Agronomy of Field Crops. Kalyani publishers, New Delhi.
5. Mukund Joshi, 2019. Text book of Field crops, PHL Learning publishers, New Delhi.

e-resources

1. www.irri.org
2. www.icar-nrri.in
3. www.icar-iirr.org
4. https://www.agriexam.com/practical-crop-production-i-ii-book-pdf.
5. http://courseware.cutm.ac.in/courses/practical-crop-production-ii-2/

23 AGR 205 CROP PRODUCTION TECHNOLOGY-II (*Rabi* CROPS) (1+1)

Learning objectives

- To impart updated technology and skills in performing different operationsin raising the crop.
- To understand the effect of climate, soil, varieties, affordable and clean energy.
- To understand the concepts of integrated weed control, integratednutrient management and conjunctive use of water.
- To know cropping systems in India and Tamil Nadu, post-harvestoperations in different crops.
- To learn about farm mechanization and resource conservation technologyfor sustainable development for the communities.

Theory

Origin, geographical distribution, Area and production, classification, nutrition quality component, economic importance, soil and climatic requirements, seasons and improved varieties. Cultural practices and yield. Post-harvest management practices. Value addition and by-products utilization of *Rabi* crops.

Unit I: Cereals

Cereals- Wheat, barley, Oats, Quinoa, Rye and Triticale.

Unit II: Pulses

Pulses- Chickpea, *Rabi* Red gram, lentil, Peas, Rajmah.

Unit III: Oilseeds

Oil seeds- Groundnut, Sunflower, Rapeseed and mustard, Safflower, Linseed.

Unit IV: Sugar and Fibre Crops

Sugar crops- Sugarcane, Sugar beet. Fibre crop- Agave.

Unit V: Tuber, Fodder and Forage crops, Narcotics crops

Tuber crops- Potato, and Sweet Potato. Fodder and forage crops- Berseem, LucerneFodder preservation techniques. Narcotics- Tobacco. Current stream of thoughts.

Practicals

Sowing methods of wheat and sugarcane, identification of weeds in *rabi* season crops. Study of morphological characteristics of *rabi* crops. Study of yield contributingcharacters 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 from oil seed crops. Visit to research stations of related crops.

Lesson Plan (Theory)	
1.	Wheat-Introduction–Origin and distribution–Area, production and productivity in World, India, and Tamil Nadu-Wheat growing zones of India-classificationof Indian wheat, varietal Improvement. Soil and climate requirements –land preparation, Seasons and Varieties–seeds and sowing– seed rate-spacing- manures and fertilizer. Water management-critical stages of irrigation- methods of irrigation and weed management-harvesting-threshing-yield attributes and yield. By-Product utilization quality parameters-Post harvesting technology-wheat based cropping systems.

2.	Barley, Oat -Introduction-economic importance–origin and distribution, area, production and productivity in the World- India and Tamil Nadu- Classificationof barley- climate, soils, land preparation, seasons and varieties – seeds and sowing - nutrient management-water and weed management- harvesting- threshing-yield attributes & yield -major cropping systems under rainfed and irrigated conditions - Post harvest management.
3.	Quinoa, Rye, and Triticale - Introduction-Economic importance-Origin and distribution, area, production, productivity in the World, India and Tamil Nadu, -climate and soil requirements-field preparation –seasons and varieties-seeds-seed rate and seed treatment- sowing manures and fertilizers-water and weedmanagement – harvesting, threshing-yield and yield attributes-cropping systems – Post-harvest management.
4.	Chickpea - Introduction-economic importance-origin and distribution-area requirement - Production and Productivity in the World, India and TamilNadu-Climate and soils-land preparation-seasons and seed rate, varieties, different types-desi, and Kabuli types- spacing-manures and fertilizers Irrigation and weed control, harvesting– threshing-yield attributes and yield- cropping systems - Post harvest handling, processing, value addition and by product utilization.
5.	*Rabi* Red gram, Lentil - origin and distribution, Reasons for increasing *rabi*red gram area – regions suitable for *rabi* red gram, area–production and productivity in– India–Tamil Nadu-suitable *rabi* varieties, soils - Climate – seasons – seeds and sowing – manures and fertilizers - irrigation – water requirement - critical stages - weed control - harvesting threshing – yield attributes and yield, cropping systems - Post harvest management.
6.	Pea, Rajma -Introduction-Economic importance-origin and distribution, area, production, productivity in the World, India and Tamil Nadu - climate and soils -land preparation season-seed rate and seed treatment – varieties- different types – field pea and garden pea- sowing time and method of sowing-spacing- manures and fertilizers-irrigation, weed control-harvesting- Threshing-yield attributes and yield-cropping systems - Post harvest management.
7.	Rape seed & Mustard --Introduction–area, production and productivity inWorld and India, Tamil Nadu, Origin and distribution–soils and climatic requirements -seasons-seeds and sowing- manures and fertilizers-irrigation– Weed control–harvesting– threshing-yield attributes and yield, cropping systems – Post-harvest management.

8.	Groundnut.-Introduction-economic importance-origin and distribution, area, production, productivity in the World, India and Tamil Nadu-habitat groups- varieties-classification - climate and soil requirements-field preparation- seasons-seed rate and treatment-sowing time and method- spacing, manuresand fertilizers- bio-fertilizer – Rhizobium – Gypsum application - irrigation, weed control- Mturity Symptoms harvesting – yield and yield attributes – Quality Parameters- Aflatoxin contamination - cropping systems - Post harvest management.
9.	**Mid – semester examination**
10.	Sunflower-Introduction-economic importance-origin and distribution-area, production, productivity in the World, India, and Tamil Nadu-climate and soil requirements-field preparation seasons and varieties-seeds and sowing , nutrient, inter cultivation-weed control- harvesting-threshing-yield and yield attributes–cultivation problems–poor seed set–reasons and remedies-Postharvest management.
11.	Safflower and Linseed -Introduction-economic importance-origin and distribution, area, production Productivity in the World, India, and Tamil Nadu-
	climate and soil requirements-field preparation seasons–varieties/hybrids- seed rate and treatment-sowing time and method- spacing-manures and fertilizers- water management -weed control-harvesting-threshing- yieldattributes and yield-cropping systems - Post harvest management.
12.	Sugarcane-Introduction-Economic importance-Origin and distribution, Area, Production Productivity in the World, India, and Tamil Nadu- Latest varieties for different situations. Climate and soils-planting seasons-different planting material-setts-short crop/nursery crop, split cane, bud chip seed/sett rate–setttreatment-spacing-planting methods. Manures and fertilizers, time and method of application, bio-fertilizers water management scheduling, methods and time of irrigation – after cultivation – parasitic weed control- ripening, judging ripening - factors affecting ripening-harvesting, yieldattributes and yield-byproducts–crop logging-special operations-blind hoeing- trash mulching. Ratoon management-varieties suitable for ratiooning-stubble shaving-weed management, Fertilizers-irrigation-special operations –mechanization in sugarcane, post-harvest handling, processing jaggery making – Value addition and by product utilization.
13.	Sugar beet-Introduction-economic importance-origin and distribution, area, production, productivity in the World, India, and Tamil Nadu- climate and soil requirements - field preparation-seasons - varieties - seed rate and treatment - sowing time and method- spacing- manures and fertilizers- irrigation-weed control-harvesting- yield attributes and yield-cropping systems- Post harvest management.

14.	Potato and Sweet Potato.-Introduction-economic importance-origin anddistribution, area, production, productivity in the World, India and Tamil Nadu-soil and climatic requirements-field preparation–seasons–seeds/seed material-seed rate and seed treatment- sowing time and methods– manures and fertilizers – irrigation – weed control – cropping systems – harvesting– yield attributes and yield - Post harvest management.
15.	Tobacco-Introduction-economic importance-origin and distribution, area, production, Productivity in the World, India and Tamil Nadu-varieties–latest –different types of tobacco. Climate and soil requirements-field preparation- nursery management-season–seeds and varieties-sowing-manures and fertilizers- -water management. Weed control-harvesting-special operations- quality characters-physical and chemical. Properties of tobacco - principle of flue-curing of Virginia tobacco – cropping systems – Post-harvest management.
16.	Agave - Importance – origin – area – production, productivity in World-India and Tamil Nadu-soil and climatic requirements- seasons – seeds - seedtreatment- sowing nursery raising- manures and fertilizers-water and weed management-harvesting-poling–reasons and strategies for poling- yield attributes and yield - Post-harvest management.
17.	Berseem, Lucerne –Introduction-economic importance-origin and distribution,Area, production, productivity in the World, India and Tamil Nadu – soils and
	climatic requirement seed bed preparation seasons and varieties –seeds and sowing time and method–spacing-manures and fertilizer requirement irrigation-time and method of harvesting–yield. Hay and Silage – FodderPreservation. Post – harvest management practices and current stream of thoughts.

Practical Schedule

1. Identification of *Rabi* crops *viz*, cereals, pulses, oilseeds, sugar, fibre, tuber and narcotics.
2. Acquiring skills in field preparation and sowing techniques in *Rabi* crops underpure andintercropping situations.
3. Acquiring skills in different seed treatment techniques for *rabi* crops.
4. Estimation of plant population and seed rate per unit area for *rabi* crops.
5. Identification of weeds and weedicide calculation.
6. Nursery preparation and management for sugarcane and tobacco.
7. Planting techniques for Sugarcane.
8. Topdressing and foliar feeding of nutrients.
9. Fertilizer management and fertilizer requirement of *rabi* crop.
10. Recording bio-metric observations of the standing *rabi* crops.
11. Acquiring skills in after-cultivation practices of *rabi* crops.
12. Study on yield parameters and estimation of yield in *rabi* crops
13. Preparation of balance sheet including the cost of cultivation
14. Visit ongoing agronomic experiments and forage production farm.

15. Visit units of mechanization and resource conservation technology.
16. Visit research stations of related crops.
17. **Practical Examination**

Course Outcomes

CO1: To understand the importance of oil seed production and cultivation of majoroilseed crops

CO2: To gain knowledge about importance of sugar crops and its Cultivation practicesCO3: To formulate different cropping systemand production technologies for various fibre crops

CO4: To construct idea regarding knowledge on growing of tuber cropsCO5: To create awareness about narcoticscrops and its production Technologies

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	-	-	1	-
CO2	3	3	-	-	1	-
CO3	3	2	3	-	3	2
CO4	3	2	-	-	3	-
CO5	3	2	-	-	1	-

References

1. Mukund joshi, 2019. Text Book of Field Crops. PHL Learning Publishers, NewDelhi.
2. B.Gururajan, R.Balasubramanian and V.Swaminathan.2014. Recent Strategies on CropProduction. Kalyani Publishers , New Delhi
3. Srinivasan Jeyaraman. 2019. Field Crops – Production and Management.Oxford & IBHPublishing, Delhi
4. Reddy, S.R. 2004. Agronomy of Feld Crops. Kalyani Publishers, New Delhi.
5. Rajendra Prasad. 2004. Text Book of Field Crop Production. Technical Editor,ICAR, NewDelhi.

e- resources

1. https://www.coabnau.in/uploads/1610422765_Agron+4.pdf
2. https://drive.google.com/file/d/1nz75V9dNihSjzKYYb_-l5DNxTReNWoMy/view
3. http://courseware.cutm.ac.in/wp-content/uploads/2020/06/CPT-II-Lecture-Notes.pdf.
4. https://www.fao.org/3/ab988e/ab988e0b.htm
5. http://megagriculture.gov.in/public/crops_fibre_crops.aspx

23 PAT 201 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIRMANAGEMENT-I (2+1)

Learning objectives

- To acquire knowledge on etiology, symptoms, epidemiology and management of diseasesof cereals and millets.
- To acquire knowledge on etiology, symptoms, epidemiology and management of diseasesof pulses and oilseed crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases ofcash

crops.

- To learn about the etiology, symptoms, epidemiology and management of diseases ofFruit crops and vegetable crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases ofspices and plantation crops.

Theory

Unit I - Diseases of cereals and millets

Etiology, symptoms, epidemiology and management of major diseases of rice, maize, sorghum, bajra, finger millet and minor millets.

Unit II: Diseases of pulses, oilseeds and cash crops

Etiology, symptoms, epidemiology and management of major diseases of blackgram, greengram, soybean, pigeonpea, groundnut, sesame, castor, sugarbeet, tobacco and mulberry.

Unit III: Diseases of fruits

Etiology, symptoms, epidemiology and management of major diseases of banana, papaya, guava, pomegranate, sapota and jack.

Unit IV: Diseases of vegetables

Etiology, symptoms, epidemiology and management of major diseases of brinjal, tomato, okra,carrot and cruciferous crops

Unit V: Diseases of spices and plantation crops

Etiology, symptoms, epidemiology and management of major diseases of ginger, cardamom, garlic, coconut, tea and coffee

Practicals

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

Lesson plan

Theory schedule

1. Introduction to field crop diseases and their significance
2. Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of diseases of rice
3. Diseases of maize
4. Diseases of sorghum
5. Diseases of bajra
6. Diseases of finger millet
7. Diseases of minor millets
8. Diseases of black gram
9. Diseases of green gram
10. Diseases of soybean
11. Diseases of pigeon pea
12. Diseases of groundnut
13. Diseases of sesame
14. Diseases of castor
15. Diseases of sugarbeet
16. Diseases of tobacco
17. Mid-semester Examination
18. Diseases of mulberry
19. Diseases of banana
20. Diseases of guava
21. Diseases of papaya

22. Diseases of pomegranate
23. Diseases of sapota and jack
24. Diseases of brinjal
25. Diseases of tomato
26. Diseases of okra
27. Diseases of carrot
28. Diseases of cruciferous
29. Diseases of ginger
30. Diseases of cardamom and garlic
31. Diseases of coconut
32. Diseases of tea
33. Diseases of coffee
34. Post harvest diseases of vegetables and fruits

Practical schedule

Study of symptoms, host-parasite relationship and management of

1. Diseases of rice
2. Diseases of maize and sorghum
3. Diseases of bajra and finger millet
4. Diseases of blackgram and greengram
5. Diseases of soyabean and pigeon pea
6. Diseases of groundnut and sesame
7. Diseases of castor and sugarbeet
8. Diseases of tobacco and mulberry
9. Diseases of banana
10. Diseases of guava and sapota
11. Field visit
12. Diseases of papaya, pomegranate and jack
13. Diseases of brinjal, tomato and okra
14. Diseases of carrot and cruciferous vegetables
15. Diseases of ginger, cardamom and garlic
16. Diseases of coconut, tea and coffee
17. Record certification

Assignment: Students should submit 50 well-pressed diseased specimens.

Course Outcome

CO 1: Acquired knowledge of etiology, epidemiology, identifying and managing diseases ofcereals and millets

CO 2: Acquired knowledge of etiology, epidemiology, identifying and managing diseases inpulses, oil seeds and cash crops

CO 3: Acquainted with the etiology, epidemiology, identifying and managing diseases in fruits

CO 4: Acquainted with etiology, epidemiology, identifying and managing diseases invegetables

CO 5: Acquainted with etiology, epidemiology, identifying and managing diseases in plantationcrops

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	2	3	-	1	1	-
CO2	2	3	-	1	1	-
CO3	2	3	-	1	1	-
CO4	2	3	-	1	1	-
CO5	2	3	-	1	1	-

References

1. Agrios, G.N. 2005. Plant Pathology, Academic Press, New York.
2. L. Darwin Christdhas Henry and H. Lewin Devasahayam 2011. Crop Diseases –Identification, Treatment and Management, New India Publishing Agencies, New Delhi.
3. Mehrota, R.S. and Ashok Aggarwal 2017. Plant Pathology – Third Edition, McGraw Hill Education, New Delhi.
4. Prakasam, V., Valluvaparidasan, V., Raguchander, T. and Prabakar. K. 1997. Field CropDiseases, AE Publication, Coimbatore.
5. Rangaswami, G. and Mahadevan A. 2005. Diseases of Crop plants in India. Prentice HallIndia Learning Private Limited, New Delhi

e- resources

1. http://eagri.org/eagri50/PATH272/index.html
2. https://agritech.tnau.ac.in/pdf/8.pdf
3. https://rvskvv.net/images/Diseases_Field-Crops_a_20.04.2020.pdf
4. http://ecoursesonline.iasri.res.in/course/view.php?id=139https://www.appsnet.org/Publications/Brown_Ogle/33%20Postharvest%20diseases%20(LMC&GIJ).pdf

23 GPB 202 PRINCIPLES OF SEED TECHNOLOGY (2+1)

Learning objectives

- To make the students to understand the importance of quality seed
- To impart the students about the genetic and agronomic of principles involved in qualityseed production
- To impart the knowledge about the techniques of seed production
- To create awareness about the seed laws pretending to the quality seeds
- To impart knowledge to the students about the seed testing methods for assessing thequality of the seeds.

Theory

Unit I: Introduction to seed quality concept

Introduction to seed technology – definitions – concept, role and goals of seed technology – differences between scientifically produced seed and grain used as seed. Deterioration of cropvarieties – Factors responsible for loss of genetic purity – Maintenance of genetic purity duringseed production – Safeguards for maintenance of genetic purity- Definition – Characters of good quality seed – factors affecting seed quality – classes ofseed – Nucleus seed, Beeder seed, foundation and certified seeds.

Unit II: Seed production techniques of various agricultural crops

Foundation and certified seed production of important cereal crops – Rice, Maize and Sorghum Foundation and certified seed production of important pulse crops – Red gram, Black gram and green gram. Foundation and certified seed production of important oilseed crops – Sesame, Sun flower and Groundnut. Foundation and certified seed production ofFiber crop – Cotton - Foundation and certified seed production of important vegetables – Tomato, Brinjal and Bhendi.

Unit III: Post harvesting seed handling techniques and seed certification.

Seed drying – Methods of seed drying – Sun drying – Forced air drying – Principle of forcedair drying – Seed drying – heated air drying system – management of seed drying operations -seed treatment its importance. Seed Processing – principles – equipments Seed certification –Phases of seed certification – Procedure for seed certification – Field inspection.

Unit IV: Seed storage techniques and seed marketing

Method of application and seed packing- Seed storage – General principles – Stages, factors affecting Seed longevity during storage – Measures for pest and disease control during storage. Seed marketing-Structure and organization – Sales generation activities, Promotional media – Factors affecting seed marketing – Role of WTO and OECD in seed marketing.

Unit V: Seed quality testing, legislation and marketing

Varietal identification through Grow Out Test (GOT) and Electrophoresis - MolecularB iochemical test – Detection of genetically modified crops – Transgene contamination innon-GM crops – GM crops and organic seed production - Seed Act 1966 – Main features of the Seed Act, 1966 – Seed Act Enforcement- Duties and powers of seed inspectors,- Offences and penalties- Seed Control Order 1983.

Practicals

Seed structure of Monocot and Dicot - Internal and External seed structure of various crops - Seed Certification and its role in seed quality - Field Inspection pattern, Methods and its importance - Seed sampling and testing – Principles and procedures - Physical Purity analysisof field crops and vegetable crops - Germination analysis of field crops and vegetable crops

Seed viability test of field crops and vegetable crops - Moisture tests of field crops and vegetable corps - Seed and seedling vigour tests of field crops and vegetable crops - Genetic purity test – Grow out test and electrophoresis - Seed blending - Visit to seed production farms

- Visit to seed testing laboratory - Visit to seed processing plant - Planning for seed production

- Cost of cultivation of seed production.

Lesson plan

Theory lecture schedule

1. Introduction to seed technology – definitions – concept, role and goals of seedtechnology – differences between scientifically produced seed and grain used as seed.
2. Seed development and maturation – Embryo development – Endosperm development –food reserves accumulation.
3. Seed dormancy –types – breaking methods – factors affecting seed dormancy
4. Seed germination – types – phases of seed germination – factors affecting seed germination
5. Definition – Characters of good quality seed – Factors affecting seed quality – Classes ofseed – Nucleus, breeder, foundation and certified seeds.
6. Deterioration of crop varieties – factors responsible for loss of genetic purity – Maintenance of genetic purity during seed production – Safeguards for maintenance of genetic purity
7. State and Central varietal release and notification – Generation system of seed multiplication
8. Foundation and certified seed production of important cereal crops – Rice and Maize
9. Foundation and certified seed production of important cereal crops – Pearl millet and Sorghum
10. Foundation and certified seed production of important pulse crops – Red gram and Blackgram
11. Foundation and certified seed production of important pulse crops – Green gram andCowpea
12. Foundation and certified seed production of important oilseed crops – Sesame and Sunflower.
13. Foundation and certified seed production of important oilseed crops – Groundnut andCastor
14. Foundation and certified seed production of fiber crop – Cotton and Jute
15. Foundation and certified seed production of important vegetables – Tomato, Brinjal andChilli
16. Foundation and certified seed production of important vegetables – Bhendi and Onion
17. **Mid semester examination**
18. Seed production techniques in Cucurbits – Ridge gourd, Bottle gourd, Cucumber,Muskmelon and Watermelon
19. Seed production techniques in Cole crops – Cauliflower, Cabbage, Radish, carrot andKnol-khol
20. Seed certification – Phases of seed certification – Procedure for seed certification
21. Field inspection – importance, procedure and various travel patterns
22. Seed extraction methods of agricultural and horticultural crops
23. Seed processing- principles and equipments – Air screen cleaner cum grader and other processing equipment - types and working principle

24. Seed drying – methods – sun drying – forced air drying – principle of forced air drying –Seed drying – heated air drying system – management of seed drying operations
25. Seed treatment its importance – Method of application and seed packing
26. Seed Testing – sampling – mixing and dividing – Seed quality estimation
27. Seed vigour test and viablity testing
28. Seed storage – general principles – Stages and factors affecting – Seed longevity during storage – Measures for pest and disease control during storage
29. Seed marketing – Structure and organization – Sales generation activities, promotionalmedia – Factors affecting seed marketing – Role of WTO and OECD in Seed Marketing
30. Varietal identification through Grow Out Test (GOT) and electrophoresis
31. Seed blending – Concept, principle and procedure
32. Seed Act 1966 – and Seed Rules 1968– main features
33. Seed Control Order 1983 – New Seed Policy, 1988 – PPV & FRA 2001.
34. Seed Village concept – Organic Seed Certification

Practical lecture schedule

1. Seed structure of monocot and dicot
2. Internal and External seed structure of various crops
3. Seed Certification and its role in seed quality
4. Field Inspection pattern, Methods and its importance
5. Seed sampling and testing – Principles and procedures
6. Physical Purity analysis of field and vegetable crops
7. Germination analysis of field and vegetable crops
8. Seed viability test of field and vegetable crops
9. Moisture tests of field and vegetable corps
10. Seed and seedling vigour tests of field and vegetable crops
11. Genetic purity test – Grow out test and electrophoresis
12. Seed Blending
13. Planning for seed production
14. Cost of cultivation of seed production
15. Visit to seed production farms and seed processing plant
16. Visit to seed testing laboratory
17. **Final practical examination**

Course outcome:

CO 1: Acquire knowledge on seed quality characteristics, varietal deterioration and various principles of seed production

CO 2: Understand the Foundation and Certified Seed production techniques and post harvestprocesses of various Agricultural crops.

CO 3: Understand the Foundation and Certified Seed production techniques and post harvestprocesses of Important Horticultural crops.

CO 4: Import knowledge about seed certification, Legislation, Storage and Marketing

CO 5: Acquire knowledge on various seed quality testing procedure, Molecular varietalidentification techniques and seed production cost analysis.

CO-PO Mapping Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	-	-	-	3
CO2	2	2	1	2	2
CO3	3	-	-	-	-
CO4	-	-	-	2	-
CO5	-	-	-	-	-

References

1. Seed Technology, Agarwal. R.L. 2017. Oxford and IBH Publication Co., New Delhi.
2. The Encylopedia of Seeds: Science, Technology and Uses., Black. M, and Bewley. JD and Halmer, 2006. CAB International Puyblications, U.K.
3. A Text Book of Seed Technology . S. Padmavathi, M. Prakash, S. Ezhil Kumar, G.Sathiya Narayanan and A. Kamaraj, NEW INDIA PUBLISHING AGENCY, New Delhi, 2021
4. Principles of Seed Science and Technology, Copeland L and Medonal MB. 2001. 4th Ed., Kluwer Academic publishers, USA.
5. Seed Technology Dhirendra Khare and Mohan S. Bhale. 2007. Scientific Publishers (India),Jodhpur.

e- resources

1. https://agritech.tnau.ac.in/
2. https://angrau.ac.in/
3. https://agrimoon.com/
4. https://ecourses.icar.gov.in/
5. https://www.seedquest.com/

23 HOR 202 PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAP ANDLANDSCAPING (2+1)

Learning objectives

- To impart knowledge on basic principles, components and practices of landscape gardening.
- To highlight the different styles of gardens and special features in a garden.
- To enable them in designing gardens using various tools and techniques
- To impart knowledge on the production technology of Cut and Loose flower crops.
- To impart comprehensive knowledge about the production technology of Medicinal and Aromatic crops

Theory

Unit I: Introductory Floriculture:

Importance, Scope, Potential of Floriculture, Flower Trading, Flowers and foliage's, Production and constraints, Famous gardens of India.

Unit II: Protected cultivation – Cut flowers:

Production technology of important cut flowers like Rose, Gerbera, Carnation, Lilium, Orchids and Anthurium under protected conditions.

Unit III: Production technology of Cut flowers and Loose flowers:

Production technology of Gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like Rose, Jasmine, Marigold, Crossandra and Nerium under open conditions.

Unit IV: Production technology of Medicinal plants and Aromatic plants:

Ashwagandha, Asparagus, Aloe, Costus, Cinnamomum, Periwinkle, Isabgol, Mint, Lemongrass, Citronella, Palmarosa, Ocimum, Rose, geranium, Vetiver. Processing and value addition.

Unit V: Landscaping:

History, Styles, Soft and Hardscape Components, Principles of landscaping, Landscape designing-drawing-manual and CAD, Practising Garden designing for Residential, Community living, Institutional, Industrial gardens and Theme parks, Horticultural crafts and current streamof thoughts.

Practicals

Identification of flower crops and ornamental plants. Identification of Medicinal and Aromatic

Plants. Propagation and planting methods, Training and pruning of Ornamental plants. Planning and layout of garden, Landscape designing-drawing-manual and CAD, Bed preparation, planting and cultural aspects of MAP. Protected structures – care and maintenance. Intercultural operations in flowers.

Harvesting and postharvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit.

Lesson plan

Theory Schedule

1. Importance and scope of floriculture crops, Flower trade and constraints
2. Institutes and agencies involving in flower trade
3. Famous gardens in India
4. Production technology of important Cut flowers like Roseunder protected conditions
5. Production technology of Gerbera under protected conditions.
6. Production technology of Carnationunder protected conditions
7. Production technology of Lilium under protected conditions.
8. Production technology of Orchids and Anthurium under protected conditions
9. Production technology of Gladiolus and Tuberose.
10. Production technology of Chrysanthemum under open conditions.
11. Package of practices for Rose
12. Package of practices for Marigold
13. Package of practices for Jasmine.
14. Package of practices for Crossandra
15. Package of practices for Nerium
16. Processing and Value addition of flower crops
17. **Mid-Semester examinations**
18. Production technology of important medicinal plants like Ashwagandha, Asparagus.
19. Production technology of Aloe, Costus and Cinnamum.
20. Production technology of Periwinkle and Isabgol.
21. Production technology of Aromatic plants like Mint, Lemongrass and Citronella.
22. Production technology of Palmarosa and Ocimum.
23. Production technology of Geranium and Vetiver.
24. Processing and value addition in MAPs.
25. History of Gardening
26. Various styles of gardens
27. Soft and Hardscape components in gardens
28. Principles of garden designing
29. Drafting techniques-Manual and CAD
30. Designing garden for Residence and community living
31. Designing garden for Institute and Industry
32. Designing garden for Public park and theme park
33. Flower arrangement-Ikebana, Moribana
34. Bonsai, Terrarium, Bouquet making and dry flowers

Practical Schedule

1. Identification of flowers and ornamental plants.
2. Protected structures – care and maintenance
3. Crop management for Rose and Gerbera
4. Crop management for carnation and Lilium
5. Crop management for Orchids and Anthurium
6. Crop management for Gladiolus and tuberose
7. Crop management for Chrysanthemum
8. Crop management for Jasmine, Marigold and crossandra
9. Identification of Medicinal plants and Aromatic Plants.
10. Crop management for Ashwagandha, Asparagus, Aloe, Costus, Cinnamomum and

Periwinkle.

11. Crop management for Isabgol, Mint, Lemongrass, Citronella, Palmarosa, Ocimum,Rose, geranium, Vetiver
12. Essential oil extraction and Value addition in MAP
13. Identification of Living and non living garden components
14. Practicing in lawn making and maintenance
15. Designing and Drafting of various gardens-Residential, Community living, Institutional, Industrial gardens and Theme parks
16. Horticultural crafts-Bonsai, terrarium, Flower arrangements, Bouquet etc
17. Final Practical Examination

Course outcome

CO 1: The students will be able to practice the nursery techniques and planting methods ofcut and loose flower crops

CO 2: The students will beable to understand the cultivation techniques of medicinal and aromatic plants.

CO3: The students will be to diagnose problems in cultivation of flower crops under protected cultivation.

CO4: The students will be able to practice the landscape designing for various places

CO5: The students will be able to practice horticultural crafts

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	3	3	0
CO 3	3	3	1	3	3	0
CO 4	1	0	3	3	2	0
CO 5	1	0	2	3	1	0

References

1. Bose, T.K. and P. Yadav. 1989. Commercial flowers. Naya Prakash Publications, Calcutta.
2. Kumar, N, Md. Abdul Khader, P. Rangasamy, and I. Irulappan, 1994. Spices, Plantation Crops, Medicinal and Aromatic plants, Rajalakshmi Publications, Nagercoil
3. Randhawa, G.S. and A. Mukhopadhyay. 1986. Floriculture in India. Allied Publishers (P) Ltd., New Delhi.
4. Prajapati, Purohit, Sharma and Kumar. 2006. A Handbook of Medicinal plants-A complete source book. Agrobios, India
5. Nursadh Ali. 2008. Medicinal plants cultivation, Mittal publications, New Delhi.

e-references

1. www.herbs.org
2. www.intuxford.tripod.com
3. www.nmpb.nic.in
4. www.agrobiosindia.com
5. www.frlht.india.org

23 AEC- 202 AGRICULTURAL MARKETING, TRADE AND PRICES (1+1)

Learning objectives

- To give exposure to the Under Graduate students on market concepts
- To understand domestic and export trade
- To study risking agricultural marketing, marketing institutions involved, price dynamics and the role

of government in regulation of markets
- To know the impact of WTO in agriculture
- To study the price stabilization measures

Theory

Unit I: Agricultural Marketing – Nature and Scope

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, , classification and characteristics of agricultural markets. - Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities. Approaches to the study of marketing - Market forces - Nature and determinants of demand and supply of farm products. Marketing of agricultural versus manufactured goods. Modern marketing systems versus traditional agricultural marketing systems

Unit II: Marketing Functions and Marketing efficiency

Marketing process and functions: Marketing process - concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transportand processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK); Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking -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;Market integration-over space, time and form: Meaning, definition and types 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; - Market Structure, Conduct and Performance paradigm (SCP) – Marketing mix and market segmentation - Market Structure: Meaning, Components, Dynamics of Conduct and Performance – Price determination under perfect and imperfect competition.

Unit III: Pricing, Promotion Strategies and Marketing Institutions

Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC; Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits and demerits, characteristics of PLC; strategies in different stages of PLC; Role of Government in agricultural marketing - Public sector institutions - CWC, SWC, FCI and DMI – their objectives and functions; cooperative marketing in India; New EXIM policy of India – Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.

Unit IV: Trade in Agricultural Products

International Trade: Concept of International Trade and its need - Free trade, Autarky and its needs -Theories of Trade: Absolute and comparative advantage; Present status and prospects of Agricultural exports / imports from India and their share - Barriers to Trade: Tariff and non-tariff barriers - Trade policy instruments – Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements – AoA and its implications on Indian agriculture: Sanitary and Phyto-sanitary issues, Market Access, Domestic Support and Export Subsidies - IPR.

Unit V: Agricultural Prices and Risk Analysis

Agricultural Prices and Policy: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization – Role of CACP –

Concept of MSP, FRP (SMP) and SAP – Price Parity - Procurement of food grains and buffer stock,FCI- Risk in marketing: Meaning and Importance - Types of risk in marketing: Speculation and Hedging - Forward and Futures trading; an overview of futures trading; – Roleof Contract Farming in risk mitigation.

Practicals

Computation of marketable and marketed surplus of important commodities; Study ofprice behavior over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by differentagencies,identification of marketing channels for selected commodity, collection of data regardingmarketing costs, margins and price spread and presentation of report in the class;Visit tomarket institutions – NAFED, SWC, CWC, Cooperative marketing society, etc to study theirorganization and functioning; Application of principles of comparative advantage ofinternational trade.

Lesson plan

Theory Schedule

1. Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing. Classification and characteristics of agricultural markets.

2Approaches to the study of marketing: Market forces. Demand and supply of agri-commodities: meaning, nature and determinants of demand and supply of farm products.

3. Marketing of agricultural versus manufactured goods.Modern marketing systems versus raditional agricultural marketing systems Producer's surplus – meaning and itstypes, marketable and marketed surplus, factors affecting marketable surplus of Agri commodities.

4. Marketing process and functions: Marketing process - concentration, dispersion and equalization. Exchange functions – buying and selling; physical functions – storage, transport and processing.

5. Facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK).Standardization, Finance, Storage and Warehousing, Processing, Value Addition and Risk Taking.

6.Market functionaries and marketing channels: Marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing reasons for higher marketingcosts of farm commodities; ways of reducing marketing costs.

7. Market Structure, Conduct and Performance paradigm (SCP) – Market Structure: Meaning, Components, Dynamics of Conduct and Performance. Market structure and Price determination under perfect and imperfect competition.

8. Marketing mix and market segmentation. Market Integration overspace, time and form: Meaning, definition and types of market integration..

9.Mid-Semester Examination

10.Product Life Cycle (PLC) and competitive strategies: Meaning and stages in PLC;characteristics of PLC; strategies in different stages of PLC.

11. Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing. Market promotion – advertising, personal selling, sales promotionand publicity – their meaning and merits and demerits.

12. Role of Government in agricultural marketing - Modern marketing systems versus traditional agricultural marketing systems.-Public sector institutions- CWC, SWC, FCI, and

DMI – their objectives and functions. Co-operative marketing in India. Advantages of AEZs, ITPO, Export Promotion Councils, APEDA, MPEDA, and Commodity Boards.

13. International Trade: Concept of International Trade and its need - Free trade, Autarky and it needs. Theories of Trade: Absolute and comparative advantage;

14. Present status and prospects of Agricultural exports / imports from India and their share.. Barriers to Trade: Tariff and non-tariff barriers - Trade policy instruments.

15. Terms of Trade - Role of institutions like UNCTAD and GATT - WTO in promoting trade in agricultural products - Free Trade Agreements. AoA and its implications on Indian agriculture: Sanitary and Phyto-sanitary issues, Market Access, Domestic Support and Export Subsidies - IPR.

16. Agricultural Prices: Meaning and functions of price; administered prices; need for agricultural price policy; Objectives of Price Policy and Price Stabilization – Role of CACP –Concept of MSP, FRP (SMP) and SAP. Price Parity - Procurement of food grains and buffer stock.

17. Risk in marketing: Meaning and Importance - Types of risk in marketing. Role of Contract Farming in risk mitigation. Speculation and Hedging and Forward and Futures trading: an overview of futures trading.

Practical Schedule

1. Preparation of Market survey schedule
2. Visit to a farm to collect information on marketing practices of agricultural commodities and marketing problems.
3. Computation of marketable and marketed surplus of important commodities.
4. Visit to a local market / weekly *shandy* / farmers' market to study various marketing Functions performed by different agencies.
5. Identification of marketing channels for selected commodity.-. Types and importance of agencies involved in agricultural marketing; marketing channels for different farm products.
6. Marketing costs, margins; price spread estimation for major agricultural and allied agricultural products.
7. Estimation of marketing efficiency and market integration.
8. Visit to market committee and regulated market to study their organization and functioning.
9. Visit to co-operative marketing society to study its organization and functioning.
10. Visit to Food Corporation of India (FCI)
11. Visit to market institutions – SWC / CWC to study their organization and functioning.
12. Visit to AGMARK Laboratory / Grading institutions.
13. Visit to NAFED
14. Visit to Commodity Boards / AEZ / Export oriented units.
15. Construction of Index Numbers and their uses.
16. Application of principles of comparative advantage of international trade.
17. **Practical Examination.**

Course Outcome

CO1: To understand the marketing channels of different commodities.

CO2: To gain the practical knowledge of price spread and its implications.

CO3: To know the role of marketing institutions and trade in agricultural products like WTO

and APEDA.
CO4: Gain practical knowledge on FCI, CWC and regulated market activities.
CO5: Role of CACP for price fixation, and price stabilization measures.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	2	-	-	-
CO2	-	-	2	-	-	2
CO3	-	-	-	1	-	-
CO4	-	-	-	2	-	-
CO5	1	-	-	-	-	1

References

1.AcharyaS.S.andAgarwal,N.L.,2011,AgriculturalMarketinginIndia,OxfordandIBHPublishing Co.Pvt.Ltd.,NewDelhi.
2.Jhingan,M.L.,2011. InternationalEconomics,VrindaPublications(P)Ltd.,NewDelhi.
3.AcharyaS.S.andAgarwal,N.L.,1994.AgriculturalPrices–AnalysisandPolicy,OxfordandIBHPublishingCo.Pvt.Ltd.,NewDelhi.
4.Kahlon A. S. and S. D. Tyagi, 2000. Agricultural Price Policy in India - Allied Publishers Pvt. Ltd. Bombay.
5.Sivarama Prasad A. 1999. Agricultural Marketing in India. Mittal Publications, New Delhi.

e-resources

1. http://www.hillagric.ac.in/edu/coa/agriecoextedursocio/lectures/agecon244.pdf
2.https://www.agrimoon.com/wp-content/uploads/Agricultural-Marketing-Trade-and-Prices-pdf.pdf
3.https://www.iaritoppers.com/
4.https://www.rvskvv.net/images/II-Year-II-Sem_Agri-Marketing_ANGRAU_20.04.2020.pdf
5.http://jnkvv.org/PDF/10042020083748concept%20of%20ag%20markeing_EgEcon530.pdf

23 AHS 202 POULTRY AND FISHERIES MANAGEMENT (1+1)

Learning Objectives

- To educate students about the current status of the poultry industry and the issues confronted by the poultry producers.
- To provide practical information on broiler and layer management in order to increase production levels.
- To impart sufficient knowledge on the construction of poultry houses using high-quality

materials in order to comply with safety regulations and to prevent disease transmission.

- To familiarize with different types of inland fish and their importance in human nutrition.
- To provide field-oriented skills in fish and poultry production as part of an integrated farmmodel.

Theory

Unit I : Introduction to Poultry Management

Introduction - Significance of poultry industry in Indian economy – Census - common nomenclatures used in poultry husbandry practices - systems of farming - Extensive, semi intensive, Intensive system and integrated farming system - class – breeds – variety -strains with examples

Unit II : Broiler Management

Broilers - commercial strains of broiler - Housing - site selection - floor space requirement of different age groups / systems - Cage Vs deep litter - Brooding management - Litter management - Feeding Management - Feed Conversion Ratio (FCR)

Unit III : Layer Management - I

Layers - Commercial Strains of Layers - Housing Management - deep litter - cage system - Slat cum Deep litter system - floor space requirements for different age groups / systems - Brooder, grower and layer management

Unit IV: Layer Management - II

Lighting management - feeding management - Deworming and Vaccination Schedule - Feed Conversion Ratio (FCR) - Hen Housed Egg production (HHEP) - Hen Day Egg production (HDEP)

Unit V : Fisheries Management

Types of common fresh water fishes - Integrated Fish farming- Fish preservation – Fishmeal - Production, processing, importance in poultry feeding and current stream of thoughts.

Practicals

External parts of chicken-Deworming-Vaccination schedule -Parts of egg-Poultry farm equipments-Feed and feed ingredients-Grading of egg- Slaughtering of chicken -Economic traits- Preservation of egg and meat -Brooding-Debeaking -Processing of Fish meal.

Lesson Plan

Theory schedule

1. Introduction, significance, scope and census of chicken
2. Common Nomenclatures in chicken- systems of farming- Extensive, intensive, Semi-Intensive and Integrated farming system
3. Class, breeds, Variety and Strains of chicken with examples
4. Introduction to Broilers - Housing Management - Selection of site
5. Cage Vs Deep litter system - merits and demerits
6. Floor space requirement of different age group birds / systems - Brooding Management
7. Litter Management - Qualities of Litter and its maintenance
8. Feeding Management of broilers - Feed Conversion Ratio (FCR)
9. **Mid-Semester Examination**
10. Introduction to layer - housing Management- Deep litter system - cage system- slat cumDeep litter system
11. Floor space requirement of different age groups / Systems - Brooder Management
12. Grower and Layer management
13. Lighting Management – HHEP - HDEP
14. Feeding Management
15. Bio security - Fumigation and disease prevention
16. Introduction to common fresh water fishes- integrated fish farming
17. Fish preservation- Fish meal, its processing & importance in poultry feeding and currentstream of thoughts.

Practical Schedule

1. Study of external parts of chicken
2. Deworming in layers
3. Vaccination schedule in Broilers & layers
4. Parts of egg
5. Identification of poultry farm equipments
6. Identification of feed and feed ingredients
7. Grading of egg
8. Slaughtering of chicken and dressing percentage.
9. Important economic traits of broiler & layers- FCR/ HDEP/HHEP
10. Preservation of egg
11. Preservation of chicken meat
12. Brooder Management
13. Debeaking in poultry
14. Processing of Fish meal and its inclusion level in poultry feed
15. Visit to poultry farm
16. Visit to fish farm
17. **Practical Examination**

Course Outcome

CO 1: The students gain knowledge in basic concepts of scientific rearing of poultry.

CO 2: Further, they would enrich on poultry management practices including feeding, housing and lightning management.

CO 3: Students would be able to analyse and solve different problems arising in broilerand layer management.

CO 4: This course encompasses all relevant information and serve as source of knowledge to understand the modern techniques used in animal husbandrysector.

CO 5: To understand about the basics of fish farming and fresh water fishes.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	**3**	**-**	**2**	**2**	**3**	**1**
CO 2	**2**	**-**	**2**	**2**	**2**	**1**
CO 3	**2**	**-**	**2**	**3**	**2**	**-**
CO 4	**2**	**-**	**3**	**3**	**3**	**1**
CO 5	**3**	**-**	**1**	**2**	**1**	**-**

References

1. Jagdish Prasad, 2016. Poultry Production and Managment, Kalyani Publishers.Darya Ganj, New Delhi-2.
2. Kadirvel.R and Balakrishnan.V., 1998. Hand Book of Poultry Nutrition. Madras Veterinary College, TANUVAS, Chennai.
3. Prabakaran, R., 1998. Commercial Chicken Production. Publisher P.Saranya, 5/2,Ramalingam Street, Seven Wells, Chennai.
4. Rabi Narayana Misra, 2016. Fishery Management, Discovery Publishing House Pvt. Ltd,New Delhi.
5. Yadav B.N,2020. Fish and Fisheries, Daya Publishing House, New Delhi.

e- Resources

1. https://agritech.tnau.ac.in/animal_husbandry/animhus_poultry_index.html
2. http://www.ignouhelp.in/ignou-olp-01-study-material/
3. http://lms.tanuvas.ac.in/course/view.php?id=44
4. https://kvkanjaw.nic.in/pages/Publication/Training%20Munual%20on%20Poultry.pdf
5. https://www.academia.edu/43806750/Introduction_to_poultry_farming

23 ECENT 202 URBAN ENTOMOLOGY (2+1)

COURSE SCHEDULE: Lecture and title

1 Introduction part I: Urban pests: their importance and habitats
2 Introduction part II: Principles of urban pest management
3 Urban Pesticides part I: Classification, risks, and non-synthetic insecticides
4 Urban Pesticides part II: Synthetic insecticides, insecticide resistance
5 Cockroaches part I: Identification, biology of important species
6 Cockroaches part II: Cockroach management Lab experiment I. Efficacy of selected insecticides against the German cockroach
7 North America Termite taxonomy, general biology, and economic importance
8 Termite management and other wood destroying insects
9 Ant diversity, biology, and economic importance
10 Important ant pests and their management
11 Stinging wasps and their management
12 Stinging bees and their management
13 Diversity and importance of stored product pests
14 1 Management of stored product pests Mid-term exam
15 Ectoparasites I: fleas, lice, ticks
16 Ectoparasites II: Mites, kissing bugs, bed bugs, delusory parasites
17 Occasional invaders I: Arthropods other than Insects
18 Occasional invaders II: The Insects
19 Fabric insects: clothes moths, carpet beetles
20 Flies part I: Importance of flies, fly biology, important filth flies
21 Flies part II: Small flies, biting flies, midges, management of flies Lab experiment II. Behavior of bed bugs
22 Mosquito morphology, biology, and mosquito transmitted diseases
23 Important mosquito species in urban environment and their management
24 Rodents
25 Pesticide legislation and integrated pest management

23 ECAEC-203 PROJECT MANAGEMENT (2+1)

Learning objectives

To provide knowledge to the students on project selection, formulation, financial feasibility analysis, monitoring and evaluation techniques with reference to agricultural sector.

- To study the human resource in project management
- To know the project management techniques
- To understand indicators for monitoring
- To know the types of evaluation system

Theory

Unit I:Introduction to ProjectManagement

Introduction-Project definition-Project characteristics-Project performance dimensionsProject cycle -Project classification-Agricultural Project- Project management -Benefits of Project

Management Approach. Project identification–Formulation-Economic and market analysisPre-feasibility Studies / Opportunity Studies-Feasibility Study -Environmental impact study-Financial analysisUndiscounted Cash Flow Analysis -Pay-back period- Return on Investment(ROI)Discounted Cash Flow Analysis: NPV, BCR and IRR- Risk and uncertainty-Project appraisal-Detailed project report.

UnitII: Human Resource in Project Management

Project organization design Human resource management-Role management-Team building Communication-Motivation-Decision making leadership Appraisal -Social Cost Benefit Analysis (SCBA).

Unit III:Project Management Techniques

Project management techniques-Bar Charts -Gantt Chart-Milestone Chart -Networks - Programme Evaluation and Review Technique (PERT)-Network diagram-Computation of EST&LST-Steps for Network Analysis. CPM -Network Revision -Project Crashing-Time-Cost Relationship of an Activity -Normal and crash situations-Project Crashing - Project Control-Redrawing Network- Progress Report.

Unit IV: Monitoring

Monitoring– Introduction, basic elements, importance -Monitoring and progress reporting-Monitoring techniques-Indicators for monitoring-Types of monitoring- Monitoring risk and uncertainties.

UnitV:Evaluation

Evaluation–Definition, introduction, features, importance-comparison of appraisal, monitoring and evaluation-Types of evaluation-Designing monitoring and evaluation system- Salient aspects of evaluation-Quantitative and qualitative approaches – Participatory monitoring and evaluation-Social audit-Evaluation report. Current Streams of thought.

Practicals

Developing skills in identification of projects - Formulation of projects -Measuring of cost and benefit of projects - Appraisal of project using undiscounted and discounted techniques - Use of sensitivity analysis - Selection methods among mutually exclusive projects - Preparation of case studies - Social cost benefit analysis – Developing network techniques for project management -PERT, CPM - Time cost relationship of and activity - Use of management tools in project monitoring - Analyzing risk in projects -Environmental Impact Assessment.

Lesson plan

Theory Schedule

1. Introduction-Project definition-Project characteristics-Project performance dimensions
2. Project cycle -conceptualization, planning, execution phases
3. Project classification-Differences between Industrial projects and Developmental projects-Agricultural Project
4. Project management -Benefits of Project Management Approach
5. Project identification–Formulation-Economic and market analysis

6. Pre-feasibility Studies / Opportunity Studies-Feasibility Study
7. Environmental impact study-Financial analysis
8. Undiscounted Cash Flow Analysis -Pay-back period- Return on Investment(ROI)
9. Discounted Cash Flow Analysis: Net Present Value (NPV)- Profitability Index(PI)/BenefitCost Ratio- Internal Rate of Return (IRR)
10. Risk and uncertainty-Economic benefit–Management aspects
11. Project appraisal–Market, Technical, Economic appraisal
12. Time Frame for Project Implementation -Feasibility Report
13. Detailed project report -Project organization design
14. Human resource management-Role management-Teambuilding
15. Communication-Motivation-Decision making leadership
16. Appraisal -Social Cost Benefit Analysis (SCBA)
17. Mid Semester Examination
18. Project management techniques-Bar Charts -Gantt Chart-Milestone Chart
19. Networks - Activity-on-Arrow (AOA)- Activity-on-Node (AON)- Programme Evaluation and Review Technique (PERT)
20. Dummy Activity-Critical Activity-Event-Expected Time-Slack-Steps for Network Analysis
21. Network diagram- Computation of EST&LST-Steps for Network Analysis
22. Rules for Drawing the Network-Event Numbering-Floats and their relationship-
23. CPM-Critical Path and Project Management-Examples
24. Network Revision -Reviewing the duration of activities -Final network
25. Activity Scheduling -Resource Analysis and scheduling
26. Project Crashing-Time-Cost Relationship of an Activity
27. Normal and crash situations-Project Crashing Examples- Normal and Crash parameters
28. Project Control-Steps in Project Control-Redrawing Network- Progress Report-
29. Monitoring– Introduction, basic elements, importance -Monitoringand progressreporting-Monitoring techniques
30. Indicatorsformonitoring-Typesofmonitoring-Monitoringriskanduncertainties
31. Evaluation–Definition, introduction, features, importance Comparison of appraisal, monitoring and evaluation
32. Types of evaluation-Designing monitoring and evaluation system
33. Salient aspects of evaluation-Quantitative and qualitative approaches
34. Participatorymonitoringandevaluation-Socialaudit-Evaluationreport

Practical schedule

1. Developmentskillsinidentificationofprojects
2. Formulation of projects
3. Measuring of cost and benefit of projects
4. Appraisal of project using undiscounted techniques
5. Appraisal of project using discounted techniques
6. Use of sensitivity analysis
7. Selection methods among mutually exclusive projects
8. Preparation of case studies

9. Preparation of case studies
10. Social cost benefit analysis
11. Networks-PERT-Network diagram
12. PERT-CPM analysis
13. Time cost relationships of and activity
14. Developing network techniques for project management
15. Use of management tools in project monitoring
16. Analyzing risk in projects and environmental impact assessment
17. Practical Examination

Course outcome

CO1: Understand nature and scope of financial management in agribusiness.
CO2: Identify the tools for credit, repayment and downpayments.
CO3: Do the appraisal of projects by measurement of costs, benefits and sensitivity analysis.
CO 4: Understand the monitoring and progress of the report
CO 5: Know the salient aspects of evaluation

CO-POMappingMatrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	3	-	-	-
CO2	-	3	-	-	-	-
CO3	2	2	-	-	-	2
CO4	-		-		2	-
CO5	-	2		2	-	

References

1. Chalmers,James,2002.HowtoManageProject,JaicoPublishingHouse,Mumbai.
2.Chandra,Prasanna,1995.Projects:Preparation,Appraisal,BudgetingandImplementation,TataMcGrawHillPublications,NewDelhi.
3. Gittinger,PriceJ.1982.EconomicsAnalysisofAgriculturalProjects,The JohnHopkinsUniversityPress,London.
4. Goel,B.B.1989.ProjectManagement,Deep&DeepPublications,NewDelhi.
5. LittleI.M.D.andMirelees,J.A.1974.ProjectAppraisalandPlanningforDevelopingCountries,OxfordandIBHPublishingCo.Pvt.Ltd.,NewDelhi.

e-resources

1.https://lecturenotes.in/subject/171/project-management
2.https://collegetutor.net/notes/Fundamentals_of_Project_Management_LPU_notes_pdf
3.https://www.manage.gov.in/studymaterial/PM.pdf
4.https://examupdates.in/project-management-notes/
5.https://backup.pondiuni.edu.in/sites/default/files/Project%20Managementt200813.pdf

23 ECSAC 202 AGROCHEMICALS (2+1)

Learning Objectives:

- The students are expected to gain both theoretical as well as practical knowledge on

agrochemicals-their type and role in agriculture,

- The student learn the effect on environment, soil, human and animal health; managementof agrochemicals for sustainable agriculture
- Understand how more efficient use of agrochemicals can build and improve the health ofthe soil
- Understand that reducing use of agrochemicals does not reduce productivity
- Identify the characteristics of a sustainable farm with regards to agrochemical use

Theory

Unit 1: Agrochemicals- overview

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

Unit II:- Herbicides and bio pesticides

Herbicides-Major classes, properties and important herbicides. Fate of herbicides. Plant bio- pesticides for ecological agriculture, Bio-insect repellent.

Unit III: Fungicides

Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, 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.

Unit IV: Insecticides

Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids,Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use,Fate of insecticides in soil & plant. IGRs Bio pesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

Unit V: Fertilizers

Fertilizers and their importance. Nitrogenous fertilizers: Feedstock's 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.

Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitro phosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Current stream of thoughts

Lesson Plan

Lecture Schedule

1. Introduction to agrochemicals
2. Types and role of agrochemicals in agriculture.
3. Effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.
4. Herbicides –Classification of herbicides based on chemical nature with examples.
5. Selectivity of herbicides brief note on mode of action of herbicides (Respiration,mitochondrial activity, photosynthesis, protein and nucleic acid metabolism.
6. Structure, properties and uses of 2, 4 D, Atrazine, Batchelor, Glyphosate and Benthiocarb Fate of herbicides.
7. Plant bio-pesticides for ecological agriculture and Bio-insect repellent.
8. Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use ofsulphur
9. Characteristics, preparation and use of copper, Mode of action-Bordeaux mixture andcopper

oxychloride.

10. Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation anduse of Zineb and maneb.
11. Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim,
12. Characteristics and use. . Introduction and classification of insecticides.
13. Inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates,
14. Synthetic pyrethroids Neonicotinoids, Biorationals,
15. Insecticide Act and rules, Insecticides banned, withdrawn and restricted use,
16. Fate of insecticides in soil & plant.
17. **Mid Semester Exam**
18. IGRs Bio pesticides and Reduced risk insecticides.
19. Botanicals, plant and animal systemic insecticides their characteristics and uses.
20. Fertilizers and their importance.
21. Classification with examples –Nitrogenous fertilizers- Manufacturing process and
22. properties of major nitrogenous fertilizers viz., Ammonia
23. Nitrogenous fertilizers: Feedstock's and Manufacturing of ammonium sulphate, Ammonium nitrate, ammonium chloride, urea.
24. Slow release N-fertilizers.
25. Classification of Phosphatic fertilizers: feedstock and manufacturing of single superphosphate.
26. Preparation of bone meal and basic slag.
27. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride,
28. potassium sulphate and potassium nitrate.
29. Mixed fertilizer
30. Complex fertilizers:
31. Sources and compatibility–preparation of major, secondary and micronutrient mixtures.
32. Complex fertilizers: Manufacturing of ammonium phosphates, nitro phosphates and
33. Manufacturing of NPK complexes.
34. Fertilizer control order.
35. Fertilizer logistics and marketing. Current stream of thoughts

Practicals

1. Sampling of fertilizers and pesticides.
2. Pesticides application technology to study about various pesticides appliances.
3. Quick tests for identification of common fertilizers.
4. Identification of anions in fertilizers
5. Identification of cations in fertilizers.
6. Calculation of doses of insecticides to be used.
7. To study and identify various formulations of insecticide available in market.
8. Estimation of nitrogen in Urea.
9. Estimation of water soluble P_2O_5 and
10. Estimation of citrate soluble P_2O_5 in single super phosphate.
11. Estimation of potassium in Muriate of Potash/ Sulphate of Potash by flame photometer.
12. Determination of copper content in copper oxychloride.
13. Determination of sulphur content in sulphur fungicide.
14. Determination of thiram.
15. Determination of ziram content.
16. Calculation of fertilizer requirement in preparation of mixed fertilizer
17. Practical Examination

Course Outcome:

CO1: Students will gain knowledge on chemical composition and proper understanding ofChemistry of pesticides.
CO2: Students will acquire the skills on quality monitoring of crops and pesticides throughpractices.
CO3: Students will acquire knowledge on manufacture, nutrient content and use of variousfertilizers, slow-release fertilizers and fertilizer control order etc.
CO4: Students gain practical skills in analysis of pesticides and fertilizers
CO5: Students gain knowledge in act and rules pertaining to fertilizers and pesticides usage

Co-Po Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	-	-	1	-
CO2	-	1	-	-	-	-
CO3	1	2	1	-	1	-
CO4	-	1	-	-	-	1
CO5	1	1	-	1	-	-

References

1. Handa.S.K.2004.Principles of Pesticide Chemistry. Agrobios. Jabalpur
2. John Havlin, James Beaten, Samuel Tisdale, Werner Nelson, 2005.Soil Fertility andFertilizers - An Introduction to Nutrient Management. 7th Edition, Prentice Hall. Upper Saddle River, New York
3. Sree Ramulu, U.S. 1979. Chemistry of Insecticides and Fungicides – Oxford and IBH Publishing Co., New Delhi
4. Yawalkar, K.S., J.P. Agarwal and S.Bokde.1972. Manures and Fertilizers Third revisedEdition Agri Horticultural Publishing House, Nagpur
5. Jayakumar, R and R. Jagannathan 2003.Weed Science Principles, Kalyani Publishers,Ludhiana.

e-references

1. http://www.famic.go.jp/english/index.html

23 AGR 211 EDUCATIONAL TOUR I (0+1)

IV Semester

23 AGR 301 PRACTICAL CROP PRODUCTION – II (RABI CROPS) (0+1)

Practicals

Crop planning, raising field crops in multiple cropping systems. Field preparation, seed,treatment, nursery raising, sowing, nutrient, water and weed management. Management of insect-pests diseases of crops. Harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease managementtechnologies. Preparation of balance sheet including cost of cultivation, net returns per studentas well as per team of 8-10 students.

- Each student will be allotted a minimum land area of 100/200 m^2 and he/she will do all field operations in the allotted land from field preparation to harvest and processing.
- Field preparation, seed, treatment, nursery raising, sowing, nutrient, water, weed management and management of insect-pests & diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce.
- Any irrigated upland crop (maize / sorghum / pearl millet / finger millet / cotton / groundnut / sunflower / sesame/ green gram / black gram etc.).

Practical Schedule for Irrigated upland crop (e.g. Maize/ Cotton):

- Ecosystem - Climate and weather - Seasons and varieties of India.
- Selection of field - Main field preparation - seed treatment - Application of manures and fertilizers - Sowing - Weed management and practicing pre- emergence application of herbicides - Thinning and gap filling - Estimation of plant population - Top dressing - Weed management - Water

management - Pest management - Observation on nutrientand weeds - Recording growth, yield attributes and yield

- Harvesting, threshing and cleaning the produce - Cost of cultivation and economics.

Practical Schedule

- Selection of field for ID crop cultivation
- Acquiring skill in seed treatment practices
- Study and practice of main field preparation for ID crop
- Practicing of application of manures and fertilizers for ID crop
- Practicing sowing of ID crop/ exposure to mechanized sowing
- Acquiring skill in pre-emergence application of herbicides
- Estimation of plant population and acquiring skill in gap filling and thinning
- Observation on nutritional deficiency symptoms and corrective measures
- **Mid-semester examination**
- Study of weeds and weed management in ID crop/ exposure to mechanized weeder
- Recording growth parameters and assessing dry matter production
- Study of water management practices for ID crop
- Observation of insect pests and diseases and their management
- Estimation of yield and yield parameters in ID crop
- Harvesting, threshing and cleaning of the produce/ exposure to mechanized harvestingand threshing.
- Preparation of balance sheet including cost of cultivation and net returns per student
- **Practical examination**

Note: According to the season, the crops in practical crop production – I & II can be interchanged

Course Outcome

CO 1: To gain knowledge about cultivation aspects of maize
CO 2: To demonstrate various seed treatment methods for maizeCO 3:
To evaluate different methods of planting techniques
CO 4: To acquire knowledge on mechanized farming practices

CO 5: To construct methodologies in harvesting, processing and value addition

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	-	3	-
CO2	2	-	-	-	3	-
CO3	2	-	-	3	3	-
CO4	2	-	1	1	1	-
CO5	1	-	-	-	2	1

References

1. Ahlawat, I.P.S., Om Prakash and G.S.Saini.2010. Scientific Crop Production in India.Rama Publishing House, Meerut.
2. Crop Production Guide. 2020. Directorate of Agriculture, Chennai and Tamil Nadu agricultural University, Coimbatore.
3. Rajendra Prasad. 2012. Text Book on Field Crop Production, Indian Council of Agrl. Research, New Delhi. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani publishers,New Delhi.
4. Chidda Singh.1997. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Singh,A.K. 2020. Textbook Series: Introduction to Major Field Crops (As per 5th Deans Committee Syllabus), Agrotech Publishing academy, Udaipur.

e-references

1. www.cimmyt.org.
2. https://drive.google.com/file/d/1OoCrfR0K9THsQZOM-YZJyP-zxXYX1bsw/view.
3. https://agritech.tnau.ac.in/pdf/AGRICULTURE.pdf.
4. http://14.139.51.37/centrallibrary/admin/book/b38dbbaccfPractical_ma-kharif-2.pdf.
5. https://www.coabnau.in/uploads/1610422741_Agron.3.3(AllkharifPracticals)Prefinal-converted.pdf.

23 AGR 302 RAINFED AGRICULTURE, WATERSHED MANAGEMENT AND SECONDARYAGRICULTURE (2+1)

Learning objectives

- To teach the students about the basic aspects and concepts of rain fed agriculture
- To learn about soil and water conservation techniques
- To enrich knowledge about drought management in different crops
- To acquire knowledge on water harvesting and contingent crop planning
- To enrich knowledge on watershed management

Theory

Unit I: Rain fed agriculture

Rain fed agriculture - introduction, types- history of rain fed agriculture in India - Problems and prospects of rainfed agriculture in India, characteristic features. Importance and need for development

Unit II: Soil and moisture conservation

Soil moisture conservation, climatic constraints, soil moisture constraints, cultivation practices and socio-economic constraints. Soil and water conservation techniques- In-situ soil moisture conservation- Fertilizer use in dry lands – use of organic manures – introduction of legumes in crop rotation – organic recycling and bio-fertilizer use in dry land.

Unit III: Drought and contingent crop planning

Drought - definition, classification of drought, types. Effect of moisture stress on physio-morphological characteristics drought. Efficient utilization of water through soil and crop management practices, Contingent crop planning for aberrant weather conditions. Management of crops in rain fed areas.

Unit IV: Watershed management

Water harvesting, importance and its techniques. Watershed management - Definition, concept, objectives, need and advantages, principles and components of watershed management. Action plan and organizational requirement of watershed. Current stream of thoughts.

Unit V: Secondary agriculture

Post-harvest technology- introduction- physical properties of cereals, pulses and oilseed- PHTequipment design and operation- Drying and dehydration, moisture measurement, EMC,drying, various drying method- commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators- principle, working and selection.

Practicals

Climate classification- rainfall pattern in rain fed areas of the country and pattern of onset and withdrawal of monsoons- cropping pattern of different rain fed areas in the country anddemarcation of rain fed area on map of India. Interpretation of meteorological data andscheduling 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 - cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil and moisture conservation measures. Field demonstration on construction of water harvesting structures. Determination of physical properties of grains Determination of moisture content of various grains. Visit to rain fed research station/watershed.

Lesson plan

Theory Schedule

1. Rain fed Agriculture: Introduction, types - Dry farming, dry land farming and rain fed farming
2. History of rain fed agriculture in India – CRIDA, objectives and activities.
3. Characteristics and prospects of rain fed agriculture in India
4. Significance of crop production in rain fed agriculture.
5. Importance and need for development in rain fed agriculture in India.
6. Soil moisture conservation and their need in dry land agriculture.
7. Problems of crop production in dry lands.
8. Climatic parameters- Rainfall- Variability- Temperature and other constraints.
9. Soil characteristics and their problems - Other problems (weed, socio economic,infrastructure and policy constraints).
10. Fertilizer use in dry lands – use of organic manures – introduction of legumes in crop rotation.
11. Organic recycling and bio-fertilizer use in dry land agriculture
12. Drought-Classification of drought and types of drought.
13. Effect of water deficit on physio-morphological characteristics of the plants.
14. Efficient utilization of water through soil and crop management practices
15. Mechanism of crop adaptation under moisture deficit condition- drought escaping-tolerance and resistance.
16. Measures to reduce evaporation, transpiration and ET losses, crop substitution.
17. **Mid semester examination**
18. Contingent crop planning for aberrant weather conditions – Late onset, dry spell and early withdrawal of monsoon in India and in Tamil Nadu
19. Management of crops in rain fed areas.
20. Water harvesting, importance and its techniques- In-situ and Ex-situ water harvesting inarid and semiarid areas.
21. Efficient utilization of water through soil and crop management practices-
22. Efficient utilization of water -Agronomic, mechanical and agrostological measures.
23. Management of crops and cropping systems in rain fed areas – Intercropping, sequence cropping and crop rotation- Choice of crops and cropping systems based on length ofcrop growing season – Potential cropping systems.
24. Concepts, objectives and principles of watershed management- Application of remote sensing and GIS in delineation of watershed
25. Components of watershed management- Natural resource management in arable andnon arable lands- Soil and water conservation
26. Alternate land use systems- different types of ALUS based on land capability classification.
27. Factors affecting watershed management- Technical, social, economic and policy constraints and Current stream of thoughts.
28. History of watershed concepts in India – guidelines for integrated watershed management programme.
29. Engineering properties such as physical, thermal and aero and hydrodynamic propertiesof cereals, pulses and oilseed-
30. Threshers for different crops, types of screens and separators.
31. Working principles of maize Sheller, hand and power operated decorticator
32. Drying and dehydration, moisture measurement, EMC.
33. Various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer).

34. Material handling equipment; conveyer and elevators- principle and working.

Practical Schedule

1. Study on climate classification
2. Study of rainfall pattern in rain fed areas of the country and in Tamil Nadu
3. Study of pattern of onset ,withdrawal of monsoons and length of crop growing season
4. Studies on cropping pattern of different dry land areas in the country and demarcation ofdry land area on map of India.
5. Interpretation of meteorological data and scheduling of supplemental irrigation on the basisof evapo-transpiration demand of crops
6. Drought, its significance and estimation of drought indices- MAI, AI
7. Critical analysis of rainfall and possible drought period in the country,
8. Effective rainfall and its calculation.
9. Studies on cultural practices viz; mulching and anti transpirants for mitigating moisturestress.
10. Studies on cultural practices viz; plant density, depth of sowing, thinning and leaf removalfor mitigating moisture stress.
11. Characterization and delineation of model watershed.
12. Field demonstration on soil & moisture conservation measures
13. Visit to watershed.
14. Alternate land use systems- different types of ALUS and visit to AICRP on Agroforestry
15. Determination of physical properties of grains
16. Determination of moisture content of various grains
17. **Practical examination**

Course Outcome

CO 1: The students acquire knowledge on basic aspects of rainfed agriculture and its management

CO 2: The students acquaints of the soil and water conservation techniques

CO 3: The students gain knowledge on various drought management techniques in differentcrops

CO 4: The students gets well-versed in contingent crop planning and water harvesting

CO 5: Understand technologies for threshing, shelling and drying of cereals, pulses and oilseeds.

CO-PO Mapping matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	-	2
CO2	3	2	-	-	2	
CO3	3	1	2	2	-	2
CO4	2	2	1	3	2	-
CO5	2	1	-	-	3	-

References

1. Chakraverty,A. 2000. Third edition. Post-harvest technology of cereals, pulses and oilseeds. Oxford & IBH publishing & Co. Pvt. Ltd., New Delhi.
2. Dhruva Narayana, V.V. Shastri, G.S. and Patnail, V.V, 1990. Watershed Management inIndia. ICAR, New Delhi.
3. Jat M.L., Sharma S.K., Balyan J.K., Kothari A, K and Jain A. K. 2012. Rainfed Farming. Kalyani Publications. Ludhiana, Punjab.
4. Murthy, J.V.S.1994. Watershed Management in India, Wiley Eastern Publishers, NewDelhi.
5. Panda S C. 2012. Dryland Agriculture. Agrobios, Publication Jodhpur, Rajasthan.

e-resources

1. https://agrigyan.in/rainfed-agriculture-and-watershed-management-hindi-pdf/
2. https://cllmp.com/wp-content/uploads/2019/06/Soil-and-water-conservation-manual.pdf
3. https://de.slideshare.net/PoojaGoswami27/lecture-no-5-drought-and-its-management

4. https://agritech.tnau.ac.in/pdf/2011/tncontingencyplan2011-district.pdf
5. http://agritech.tnau.ac.in/agriculture/agri_majorareas_watershed_watershedmgt.html

23 ENT 301 PESTS OF CROPS AND STORED GRAIN AND THEIR MANAGEMENT (2+1)

Learning Objectives:

- To study the distribution, bionomics and symptoms of damage of pests of crops andstorage.
- To distinguish various symptoms of damage
- To identify different life stages of the major pests of crops and storage
- To discuss integrated pest management protocols for major crops and pests
- To perform rearing and collection of major pests for better understanding of their biologyand identification characters

Theory

Economic Classification of Insect Pests, Distribution, Bionomics, Symptoms of damage and Integrated management strategies for insects and non-insect pests such as mites, nematodes,rodents, birds and other vertebrates of the following crops.

Unit I: Pests of Cereals, Millets and Pulses

Rice, Wheat, Maize, Sorghum, Cumbu, Ragi, Tenai; Redgram, Greengram, Blackgram, Bengal gram, Cowpea and Soybean

Unit II: Pests of Oilseeds, Cotton, Sugarcane, Green manures, Forage crops andTobacco

Groundnut, Castor, Sesame, Sunflower, Safflower, Linseed, Jatropa, Mustard; Cotton; Sugarcane; Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; Tobacco

Unit III: Pests of Vegetables, Tubers, Spices and Plantation crops

Brinjal, Tomato, Bhendi, Crucifers, Cucurbits, Moringa, Amaranthus, Potato, Sweet Potato, Tapioca, Yam; Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf, Cardamom, Pepper and Betel vine; Coconut, Arecanut, Coffee, Tea, Rubber, Cocoa

Unit IV: Pests of Fruits and Forest trees

Mango, Sapota, Citrus, Cashew, Banana, Grapevine, Guava, Jack, Custard apple, Pomegranate, Pineapple, Papaya, Aonla, Ber, Tamarind, Apple; Neem, Teak, Sandalwood, Eucalyptus, Casuarina

Unit V: Pests of Flower crops, Ornamentals, Medicinal plants and Stored products Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Greenhouse crops andMushroom, Lawn and Turf; Gloriosa, Coleus, Phyllanthus, Periwinkle, Aswagantha, Senna;Stored grains, Dry fruits and Nuts; Locusts and their management. Current Streams ofThoughts in pest management.

Practical

Identification of symptom of damage and life stages of important insect, non-insect pests such as mites, nematodes and rodents, various crops and storage – cereals, millets, pulses,oilseeds, cotton, sugarcane, green manures, forage crops, fruits, forest trees, flower crops, plants, Ornamentals, Lawn Medicinal and Stored products.

Assignment

- Collection and submission of at least 50 insect pests of crops and storage.
- Rearing a minimum of 20 insect pests of crops and storage

Theory Lecture Schedule

Distribution, Bionomics, Symptoms of damage and Integrated management strategies forinsect, non-insect pests such as mites, nematodes, rodents, birds and other vertebrate pestsof

1. Rice – Leaf feeders and borers
2. Rice – Sap feeders
3. Wheat, Maize, Sorghum
4. Cumbu, Ragi, Tenai
5. Redgram, Greengram, Blackgram
6. Bengal gram, Cowpea and Soybean
7. Groundnut

8. Castor, Sesame
9. Sunflower, Safflower, Linseed, Jatropa, Mustard
10. Cotton
11. Sugarcane
12. Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; and Tobacco
13. Brinjal, Tomato
14. Bhendi, Crucifers
15. Cucurbits, Moringa and Amaranthus
16. Potato, Sweet Potato, Tapioca, Yam
17. **Mid-semester examination**
18. Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf
19. Cardamom, Pepper and Betel vine
20. Coconut, Arecanut
21. Coffee
22. Tea, Rubber, Cocoa
23. Mango, Sapota
24. Citrus, Cashew
25. Banana, Grapevine
26. Guava, Jack, Custard apple, Pomegranate, Pineapple
27. Papaya, Aonla, Ber, Tamarind, Apple
28. Neem, Teak, Sandalwood, Eucalyptus, Casuarina
29. Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers
30. Green house crops and Mushroom,
31. Lawn and Turf
32. Gloriosa, Coleus, Phyllanthus, Periwinkle, Aswagantha, Senna
33. Stored grains, Dry fruits and Nuts
34. Locusts and their management

Practical Schedule

Identification of symptoms of damage and life stages of insect, non-insect pests such asmites, nematodes, rodents, birds and other vertebrate pests of

1. Rice, Wheat, Maize, Sorghum, Cumbu, Ragi, Tenai
2. Redgram, Greengram, Blackgram, Bengal gram, Cowpea and Soybean
3. Groundnut, Castor, Sesame, Sunflower, Safflower, Linseed, Jatropa, Mustard
4. Cotton, Sugarcane
5. Sunhemp, Sesbania, Daincha, Glyricidia; Lucerne, Subabul; and Tobacco
6. Brinjal, Tomato, Bhendi, Crucifers, Cucurbits, Moringa and Amaranthus, Potato, SweetPotato, Tapioca, Yam
7. Chillies, Onion, Garlic, Ginger, Turmeric, Coriander, Curry leaf, Cardamom, Pepper andBetel vine
8. Coconut, Arecanut
9. Coffee, Tea, Rubber, Cocoa
10. Mango, Sapota, Citrus, Cashew, Banana, Grapevine
11. Guava, Jack, Custard apple, Pomegranate, Pineapple, Papaya, Aonla, Ber, Tamarind,Apple
12. Neem, Teak, Sandalwood, Eucalyptus, Casuarina, Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers
13. Green house crops and Mushroom, Lawn and Turf, Gloriosa, Coleus, Phyllanthus,Periwinkle, Aswagantha, Senna, Stored grains, Dry fruits and Nuts
14. Methods of grain sampling under storage conditions
15. Fumigation of grain store/godown.

16. Visit to nearest FCI godowns
17. Orientation for final practicalexamination

Course Outcome:

CO 1: Define bionomics, symptoms of damage and integrated management strategies forpests of cereals, millets and pulses

CO 2: Discuss bionomics, symptoms of damage and integrated managementstrategies forpests of Oilseeds, Cotton, Sugarcane, Green Manures, Forage Crops and Tobacco

CO 3: Explain bionomics, symptoms of damage and integrated managementstrategies forpests of Vegetables, Tubers, Spices and Plantations

CO 4: Define bionomics, symptoms of damage and integrated managementstrategies for pests of Fruits, Ornamentals and Medicinal Plants

CO 5: Discuss bionomics, symptoms of damage and integrated management strategies forpests of Tree, Lawn, Stored Products, Mushroom and greenhouse crops

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	3
CO2	3	3	3	2	3	3
CO3	3	3	3	2	3	3
CO4	3	3	3	2	3	3
CO5	3	3	3	2	3	3

References

1. Atwal, A.S. and G.S. Dhaliwal. 2003. *Agricultural Pests of South Asia and theirManagement*, Kalyani Publishers, Ludhiana, 487p.
2. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai. 386p.
3. Regupathy, A. and R. Ayyasamy. 2013. *A Guide on Crop Pests*. Namrutha Publications,Chennai, 368p.
4. Parvatha Reddy. 2010. *Insect, Mite and Vertebrate Pests and their Management inHorticultural Crops*. Scientific Publishers, Jodhpur. 384p.
5. Nair, M.R.G.K. 1995. *Insects and Mites of Crops in India*. Indian council of Agricultural Research, New Delhi, 408p.

E-Resources

1. http://www.ncipm.org.in
2. http://agritech.tnau.ac.in/
3. http://www.nbaii.res.in/
4. http://www.nrcg.res.in/
5. ipm.illinois.edu

23 PAT 301 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIRMANAGEMENT-II (2+1)

Learning objectives

- To acquaint with the symptoms, etiology, disease cycle and management of diseases ofwheat and pulse crops.
- To acquaint with the symptoms, etiology, disease cycle and management practices of important diseases of oilseeds and cash crops.
- To know about the symptoms, etiology, disease cycle and management practices ofimportant diseases of fruits and vegetables crops.
- To know about the symptoms, etiology, disease cycle and management practices ofimportant

diseases of spices and plantation crops.

- To know about the symptoms, etiology, disease cycle and management practices ofimportant diseases of flower crops.

Theory

Unit-I Diseases of cereals and pulses

Symptoms, etiology, disease cycle and management of wheat, cowpea and chickpea.

Unit-II Diseases of oilseeds and cash crops

Symptoms, etiology, disease cycle and management of sunflower, safflower, mustard,sugarcane, cotton and lentil.

Unit-III Diseases of fruits and vegetables

Symptoms, etiology, disease cycle and management of mango, citrus, grapevine, apple,peach, pineapple, strawberry, potato, cucurbits, sweet potato, cassava, colocasia

Unit-IV Diseases of spices and plantation

Symptoms, etiology, disease cycle and management of chillies, turmeric, pepper, betelvine, coriander, cocoa, rubber and arecanut

Unit-V Diseases of flower crops

Symptoms, etiology, disease cycle and management of rose, jasmine, crossandra,chrysanthemum and marigold

Practicals

Identification and histopathological studies of selected diseases of field andhorticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

Lesson plan

Theory schedule

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of

1. Diseases of wheat
2. Diseases of cowpea
3. Diseases of chickpea
4. Diseases of sunflower
5. Diseases of safflower
6. Diseases of mustard
7. Diseases of sugarcane
8. Diseases of cotton
9. Diseases of lentil
10. Diseases of mango
11. Diseases of citrus
12. Diseases of grapevine
13. Diseases of apple
14. Diseases of peach
15. Diseases of pineapple
16. Diseases of strawberry
17. Mid-semester examination
18. Diseases of potato
19. Diseases of cucurbits
20. Diseases of sweet potato
21. Diseases of cassava and colocasia
22. Diseases of chilli
23. Diseases of turmeric
24. Diseases of pepper

25. Diseases of betelvine
26. Diseases of coriander
27. Diseases of cocoa
28. Diseases of rubber
29. Diseases of arecanut
30. Diseases of rose
31. Diseases of jasmine
32. Diseases of crossandra
33. Diseases of chrysanthemum
34. Diseases of marigold

Practical Schedule

Study of symptoms and host-parasite relationship of:

1. Diseases of wheat
2. Diseases of cowpea and chickpea
3. Diseases of sunflower, safflower and mustard
4. Diseases of sugarcane, cotton and lentil
5. Diseases of mango and citrus
6. Diseases of grapevine and pineapple
7. Diseases of apple, peach and strawberry
8. Field visit
9. Diseases of potato and sweet potato
10. Diseases of cucurbits
11. Diseases of cassava and colocasia
12. Diseases of chilli, turmeric and pepper
13. Diseases of betelvine and coriander
14. Diseases of rubber, cocoa and arecanut
15. Diseases of rose and jasmine
16. Diseases of crossandra, chrysanthemum and marigold
17. Record certification

Assignment: Students should submit 50 well-pressed diseased specimens.

Course outcome

CO 1: Acquainted with identifying and managing diseases of cereals and pulses
CO 2: Acquainted with identifying and managing diseases in oilseeds and cash crops
CO 3: Having in depth knowledge in identifying and managing diseases in fruits and vegetables
CO 4: Having in depth knowledge in identifying and managing diseases in spices and plantation
CO 5: Having in depth knowledge in identifying and managing diseases in flower crops

CO-PO Mapping matrix

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	2	3	-	1	1	-
CO2	2	3	-	1	1	-
CO3	2	3	-	1	1	-
CO4	2	3	-	1	1	-
CO5	2	3	-	1	1	-

References

1. Agrios, G.N. 2005. Plant Pathology, Academic Press, New York.

2. Darwin Christdhas Henry L. and Lewin Devasahayam H. 2011. Crop Diseases –Identification, Treatment and Management, New India Publishing Agencies, New Delhi.
3. Mehrota, R.S. and Ashok Aggarwal 2017. Plant Pathology – Third Edition, McGraw Hill Education, New Delhi.
4. Devappa V., Dinesh Singh and Jahagirdar S. 2017. Diseases of Ornamental Crops. Todayand Tomorrows Printers and Publishers.
5. Dinesh Singh, Chowdappa P. and Pratibha Sharma. 2014. Diseases of Vegetable Crops:Diagnosis and Management. Today and Tomorrows Printers and Publishers.
6. Rangaswami, G. and Mahadevan A. 2005. Diseases of Crop plants in India. Prentice HallIndia Learning Private Limited, New Delhi

e- resources

1. http://www.eagri.org/eagri50/PATH371/index.html
2. https://rusttracker.cimmyt.org/wp-content/uploads/2011/11/CIMMYT_Wheat_Diseases_Pests_ID_GUide.pdf
3. http://eagri.org/eagri50/PATH272/lecture11/lec07.pdf
4. https://plantvillage.psu.edu/topics/apple/infos
5. https://www.icco.org/pests-diseases/
6. https://extension.tennessee.edu/publications/Documents/W833.pdf

23 SOL 301 GEOINFORMATICS, NANO-TECHNOLOGY AND PRECISION FARMING (1+1)

Learning Objectives

- To introduce the basic concepts of precision farming
- To create awareness about various applications of remote sensing and GIS in precision agriculture
- To impart knowledge to the students on the nanotechnology in precision farming
- Evaluate the role of geoinformatics in agriculture
- To gain knowledge on crop simulation models

Theory

Unit 1: Precision farming

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture.

Unit 11: Geo-informatics

Geo-informatics- definition, concepts, tool, and techniques; Remote sensing concepts and application in agriculture; Image processing and interpretation. Crop discrimination and yield monitoring, soil mapping. Fertilizer recommendation using geospatial technologies. Spatial data and their management in GIS. Global positioning system (GPS), components and its functions andtheir use in Precision Agriculture

Unit 111: Techniques to precision farming

Introduction to crop simulation models and their uses for optimization of agricultural inputs. STCR approach for precision agriculture

Unit IV: Basics Nanotechnology

Nanotechnology, definition, concepts and techniques, brief introduction about nano scaleeffects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors.

Unit V: Applications of nanotechnology

Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity. Current stream of thoughts

Lesson Plan

Lecture schedule

1. Precision agriculture- introduction, scope, implications, issues ,role and concerns concepts and techniques , componentsand its in Indian agriculture.

2. Geo informatics- definitions and terminology, concepts, techniques and tools ,theiruse in precision agriculture.
3. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendationusing geospatial technologies.
4. GIS -components of GIS, Spatial data and their management,Graphic representation of data- Vector /Raster- models-digitization.Data- creation of data- storage of data- geo coding and geo referencing –data file management –input methods and analysis -overlay analysis- GIS data outputs- maps, graphical outputs.
5. Remote sensing- concepts – applications in agriculture images – sensor systems- satellites, types- NOAA satellites, GOES satellites, INSAT,IRS, SEASAT,OCEANSAT-1,IKONOS
6. Digital image processing and interpretation- transformations- DTM, Triangulated irregular network (TIN)-Applications of DTM. Application of modelling in agriculture- crop yield models- simulation models-growth models
7. Global positioning Systems (GPS)- components, functions and applications.
8. **Mid Term Examination**
9. Integration of Remote sensing and GIS -need for integration-applications
10. Soil fertility management- Soil Test crop response (STCR) studies , Crop Simulation Models and their uses for optimization of agricultural inputs.
11. Nanotechnology -introduction– history – terminologies – definitions-– basic concepts, nano scale, nano dimension effects.
12. Nanoparticles, nano materials, nano structures – their properties,
13. Synthesis of nano particles – concepts, up - down and bottom-up approaches, methods – attrition, pyrolysis ,chemical synthesis – soil gel process . principles, physical
14. Nano structured materials – fullerenes, nano tubes, nano filters, nano clays, nano balls, bulky balls etc.- properties and synthesis. Nano composites – polymers, nano crystals etc. – properties and synthesis
15. Nano technology in Agriculture and allied fields – nano farming , precision farming Nano technology in soil fertility management – nano fertilizers, nano pesticides,soil binders, nano sensors, smart delivery mechanism to targeted site for promoting nutrient availability.
16. Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity. Current stream of thoughts

Practical schedule

1. Precision agriculture
2. Geo-informatics in precision agriculture
3. Crop discrimination and spectral features for crop classification
4. Yield monitoring and soil mapping
5. Site specific nutrient management
6. Spatial data and its management
7. Godsey and its basic principles
8. Remote sensing and its application in agriculture
9. Image processing and interpretation
10. Global positioning system, components, and its function
11. Simulation and crop modelling
12. STCR approach for fertilizers recommendations
13. Nano technology and nano scale sensors
14. Ano pesticides, nano fertilizers, and nano sensors
15. Nano biosensors
16. Use of nano technology.
17. Practical examination

Course outcome

CO.1: Concepts and techniques of Precision agriculture

CO.2: Learn about tools and techniques of geoinformatics used in precision farming

CO.3: Precision agriculture can address both economic and environmental issues thatsurround production agriculture today.

CO.4: Learn about tools and techniques of nanotechnology in relation to agricultureCO.5: Application of crop simulation models.

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	1	1	-
CO2	-	-	1	1	1	-
CO3	-	1	1	-	2	-
CO4	-	-	1	-	-	1
CO5	-	-	-	1	-	1

Reference book

1. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers & Distributors
2. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. AppleAcademic Press
3. Reddy. S.R. 2021. Geoinformatics and Nanotechnology for Precision Farming. Kalyani publisher, Ludhiana.
4. Sanjeev Kumar, S.N. Saravaiya, and A.K. Pandey. 2021. Precision Farming and Protected Cultivation: Concepts and Applications. CRC Press
5. Srivastava, G.S. 2014. An Introduction to Geoinformatics. McGrew Hill Education (India) Pvt. Ltd. , New Delhi

e-resources

1. https://agrilpu.blogspot.com
2. https://www.agrimly.in
3. http://bscagristudy.online
4. https://www.coursehero.com

23 GPB 301 CROP IMPROVEMENT - I (Kharif Crops) (1+1)

Learning objectives

- To impart knowledge about the origin, evolution and modes of reproduction for different Kharif crops.
- To impart knowledge about the floral biology, crossing techniques, objectives of breeding and wild species as donors for resistant traits.
- To impart knowledge about the Genetics and Genomic relationship of Yield and Quality characters for different Kharif crops.
- To impart knowledge about the Biotic and Abiotic stress resistance breeding for different Kharif crops.
- To provide insight into recent advances in improvement of cereals, millets, pulses, oil seeds, fibre crops, vegetables using conventional and modern biotechnological approaches.

Theory

Unit I: Mode of reproduction and pollination control in kharif crops

Introduction - definition, aim, objectives and scope of crop improvement - Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops - Centers of origin - Law of homologous series - types of centres of diversity

- gene sanctuaries - genetic erosion - main reasons of genetic erosion - extinction - introgression - gene

banks -Types of gene banks - distribution of crop species.

Unit II: Breeding methods for cereals, pulses, millets and oilseed crops

Centres of origin, distribution of species, wild relatives in different cereals, millets, pulses and oil seeds - **Cereals -** rice, maize - **Millets -** sorghum, pearl millet and ragi - **Pulses** - redgram, urdbean, mungbean, soybean - **Oilseeds -** groundnut, sesamum and castor.

Unit III: Breeding methods for fodder, fibre and cash crops

Centres of origin, distribution of species, wild relatives in different fodder crops, fibre crops andcash crops - **Fodder crops -** Napier grass and Para grass - **Fibre crops** - Cotton - **Cash crops** - Tobacco.

Unit IV: Breeding methods for vegetable and fruit crops

Centres of origin, distribution of species, wild relatives in different vegetable crops and horticultural crops - **Vegetable crops** - Tomato, brinjal, chilli, bhendi- **Horticultural crops -** Mango, banana, guava, papaya.

Unit V: Hybrid seed production for kharif crops

Study of genetics of qualitative and quantitative characters - Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops - Major breeding objectives and procedures including conventional and modern innovative approaches for development ofhybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (Physical, chemical, nutritional) - Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops - Hybrid seed production technology in maize, rice, sorghum, pearl millet and pigeon pea - Ideotype concept and climate resilient crop varieties for future - Breeding for drought , salinity, water logging, high temperature and low temperature tolerant varieties in different crops.

Practicals

Observation of floral biology - Anthesis and Pollination - Selfing and crossing techniques-study of wild species in the above crops.

Lesson plan

Theory lecture schedule

1. Introduction - definition, aim, objectives and scope of Crop Improvement.
2. Breeding objectives and important concepts of breeding self pollinated, cross pollinatedand vegetatively propagated crops.
3. Centres of origin - Law of homologous series-Types of centres of diversity.
4. Gene sanctuaries-Genetic erosion - main reasons-extinction-introgression.
5. Gene banks - types of gene banks- distribution of crop species.
6. Centres of origin, distribution of species, wild relatives of the cereal crops : Rice, Maize, Millets: Sorghum, Pearl millet and Ragi.
7. Centres of origin, distribution of species, wild relatives of Pulses: Redgram, Urdbean , Mungbean, Soybean
8. Centres of origin, distribution of species, wild relatives of Oil seeds: Groundnut, Sesamumand castor.
9. **Mid semester examination**.
10. Centres of origin, distribution of species, wild relatives of Fodder crops: Napier grass andPara grass, Fibre crops : Cotton
11. Centres of origin, distribution of species, wild relatives of Cash crops : Tobacco, Vegetablecrops : Tomato, Brinjal, Chilli, Bhendi.
12. Centres of origin, distribution of species, wild relatives of Horticultural crops : Mango, Banana, Guava and Papaya.
13. Study of genetics of qualitative and quantitative characters. Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops.
14. 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).

15. Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops
16. Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeon pea. Ideotype concept and climate resilient crop varieties for future.
17. Breeding for drought, salinity, waterlogging, high temperature and low temperature tolerant varieties in different crops.

Practical schedule

1. Floral biology - Types of inflorescence, flower structure of mononcots and dicots, floral formula and diagram.
2. Emasculation and hybridization techniques in Rice and Maize.
3. Emasculation and hybridization techniques in Sorghum, Pearl millet, Ragi.
4. Emasculation and hybridization techniques in Pigeon pea, urdbean, mung bean andcowpea.
5. Emasculation and hybridization techniques in Soybean, Groundnut and Sesamum.
6. Emasculation and hybridization techniques in Castor, Cotton and Tobacco.
7. Maintenance breeding of different Kharif crops - Rice, Maize, Sorghum, Redgram, Groundnut.
8. Maintenance breeding of different Kharif crops - Castor, Cotton and Tobacco.
9. Handling of germplasm and segregating generations by different methods - Pedigree, Bulkand Single seed descent methods.
10. Study of field techniques for varietal seed production and hybrid seed production in Rice,Maize.
11. Study of field techniques for varietal seed production and hybrid seed production in Sorghum and Redgram.
12. Study of field techniques for varietal seed production and hybrid seed production inCastor and Cotton.
13. Estimation of heterosis, inbreeding depression and heritability.
14. Layout of field experiments.
15. Study of quality characters, donor parents for different traits in different kharif crops.
16. Visit to seed production plots - AICRP plots for different field crops.
17. **Final practical examination.**

Course outcome

CO 1: The course will acquaint the student with importance of floral biology, participatory plant breeding.
CO 2: Knowledge about the objectives of breeding in Kharif crops.
CO 3: Knowledge about various breeding methods of Kharif crops.
CO 4: Knowledge about different hybridization techniques for Kharif crops.
CO 5: Knowledge about hybrid seed production for Kharif crops.

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	**2**				
CO2				**3**	
CO3		**2**			
CO4					**2**
CO5			**3**		

References

1. Copra V.L. and Paroda R.S.1986. Approaches for Incorporating Salinity Resistance inCrop Plants.Oxford and IBH Publishing Co.,New Delhi.
2. Kalloo, G.1994.Vegetable Breeding. Panima Educational Book Agency, New Delhi.
3. Sharma,J.R. 1994. Principles and Practice of Plant Breeding. Tata McGraw Hill Publishing Company Ltd.,New Delhi.

4. Phundn Singh, 2006. Essentials of Plant Breeding.KalyaniPublishers,New Delhi.
5. Singh,B.D. 2006. Plant Breeding:Principles and Methods.KalyaniPublishers,New Delhi.

e-resources

1. https://isci.org.in.
2. https://adrde.org
3. https://www.cgiar.org
4. https://www.isprd.in
5. https://www.plantauthority.gov.in

23 AEC- 301Agribusiness Management (1+1)

Learning objectives

- To impart skill, training, proficiency in decision making
- To enhance ability, to direct, to coordinate and control the work at all level so management for the farm graduates
- To use the knowledge and skill gained for starting new agri business and managing the business
- To study the marketing management
- To know the preparation of bankable projects

Theory

Unit I: Agribusiness and Management

Agribusiness – Definition – Nature and Scope – Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Structure of Agribusiness (input, farm and product sectors) - Agribusiness Management - Distinctive features of Agribusiness - Importance of Agribusiness in Indian Economy and New Agricultural Policy – Agri-value chain: Understanding primary and support activities and their linkages. Business environment – PEST and SWOT analysis. Management – Definition and Importance – Management functions – Nature. Management - Skills, Levels and functional areas of management. Forms of Business Organisation – Sole Proprietorship – Partnership
–Private and Public Limited - Cooperatives.

Unit II: Management Functions

Management functions: Roles and activities, organizational culture. Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget). Steps in planning and implementation – Characteristics of Sound plan. Objectives – MBO.Organizing – Principles of Organizing – Concept of Departmentation- Delegation- Centralization – Decentralization. Staffing – Concept – Human Resource Planning – Process. Directing – Concept – Principles – Techniques, Supervision. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques. Communication – Definition and Process – Models – Types – Barriers. Leadership – Definition – Styles – Difference between leadership and management. Controlling – Concept - Steps – Types – Importance – Process.

Unit III: Functional areas of management

Functional areas: Operations, Human Resources, Finance and Marketing – Meaning and scope. Operations management: meaning – physical facilities – implementing the plan. Inventory control: meaning – inventory model – EOQ.

Unit IV: Marketing management

Financial management of agribusiness: Financial statements and their importance – Balance

sheet, Network analysis and Cash flow analysis. Marketing management: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies. Consumer behavior analysis Product Life Cycle (PLC). Sales and distribution management. Pricing policy, various pricing methods.

Unit V: Preparation of bankable project

Project management: Definition – classification of agricultural projects – Project cycle: Identification, Formulation, Appraisal, Implementation, Monitoring and Evaluation. Project appraisal and evaluation of bankable projects – Pay Back Period, BCR, NPW and IRR. Agro-based industries – importance and need – Types of agro-based industries – institutional arrangements. Procedure to set up agro-based industries, constraints in establishing agro-based industries- Laws and policies related to agri-business in India.

Practicals

Study of agri-input markets: Seed, fertilisers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retail trade commodity trading, and value added products. Study of financing institutions – Cooperative, Commercial banks,RRBs, Agribusiness Finance Limited, NABARD. Preparation of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project – Non discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return.

Lesson plan

Theory schedule

1. Agribusiness – Nature and scope – Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Agribusiness – definition - Structure ofAgribusiness (input, farm and product sectors).
2. Agribusiness Management - Distinctive features of Agribusiness - Importance ofAgribusiness in Indian Economy – New Agricultural Policy. Agri-supply chain management and agri-value chain management – Forward and Backward linkages.
3. Business environment – analyzing the demographic, economic, socio-cultural,natural, technological and political-legal environment. Business environment – PEST and SWOT analysis.
4. Management – Definition and Importance – Management functions. Management –Roles,

Skills, Levels, Activities and organizational culture. Forms of Business Organisation – Sole Proprietorship – Partnership –Private and Public Limited - Cooperatives.

5. Management functions: Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget). Steps in planning – Characteristics of Sound plan. Objectives – MBO

6. Organizing – Principles of Organizing – Organisation structure – Formal and Informal Organisation. Concept of Departmentation- Span of control – Authority and Responsibility – Concept and Meaning. Delegation- Centralization – Decentralization

7. Staffing – Concept – Human Resource Planning – Process. Directing – Concept – Principles – Techniques -ordering, leading, supervision.

8. Motivation – Concept - Maslow's Need Hierarchy Theory – Types – Techniques. Communication – Definition and Process – Models – Types – Barriers. Leadership – Definition – Styles – Difference between leadership and management.

9. Mid-semester examination

10. Controlling – Concept - Steps – Types – Importance – Process. Scheduling the work – controlling production in terms of quantity and quality – ISO standards – HACCP – TQM.

11. Functional areas of management: Operations management: meaning – operating system – physical facilities – implementing the plan. Inventory – meaning – types – inventory costs – inventory management – EOQ.

12. Financial management – financial statements – importance and need – Balance sheet, Net worth analysis and cash flow analysis. Marketing management: meaning, definition – market segmentation, targeting and positioning – 4Ps of marketing mix and marketing strategies.

13. Consumer buying behavior – factors influencing buying behavior – Buying decision process.

Sales and distribution management. Pricing policy- pricing method – pricing at various stages of marketing.

14. Project – meaning, definition – classification of agricultural projects – project cycle – Identification, formulation, appraisal, implementation, monitoring and evaluation. Project appraisal and evaluation techniques – undiscounted and discounted measures.

15. Agro-based industries – importance and need – types of agro-based industries – institutional arrangements for financing agro-based industries. Procedure to set up agro-based industries – constraints in establishing agro-based industries.

16. Business plan – components of business plan. Preparation of project reports for variousactivities in agriculture and allied sectors.

17. Laws and policies related to agri-business in India.

Practical schedule

1. Study of agro-input markets: Seeds, fertilizers and pesticides.
2. Visit to output markets – Regulated market/Uzhavarsandhai.
3. Visit to output markets – Shandies/flower market.
4. Visit to agro-processing unit to study retail trade, commodity trading and value addition.
5. Visit to Cooperatives to know their role in agriculture development.
6. Visit to Lead Bank/RRBs.

7. Visit to NABARD district office.
8. A case study of agro-based industries – preparation and presentation of project report.
9. Exercise on project evaluation techniques – Undiscounted measures.
10. Exercise on project evaluation techniques – Discounted measures.
11. Preparation of bankable project – I.
12. Preparation of bankable project – II.
13. Group presentation of projects – I.
14. Group presentation of projects – II.
15. Trend and growth rate in prices of agro-inputs.
16. Trend and growth rate in prices of agricultural commodities.
17. Final Practical examination

Course Outcome

CO1: To understand the opportunities in agribusiness sectors

CO2: To understand the marketing mix, and supply chain management in agribusiness.

CO3: To know the management functions and how to prepare agribusiness project.

CO4: To understand the components of business plan

CO5: To know the importance of financial management

CO-POMappingMatrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	-	2	-	-	-
CO2	3	-	2	-	-	-
CO3	-	-	3	-	-	2
CO4	2		-		2	-
CO5	-	2	-	-		-

REFERENCES

1.Amarnath, J.S. and Samvel, A.P.V., 2008.Agri-Business Management, Satish Serial Publishing House, New Delhi.
2.Broadway,A.C.andBroadway,Arif,A.2002.KalyaniPublishers,NewDelhi.
3.Prasad,L.M.,2005.PrinciplesandPracticesof Management, Sultan Chand and Sons Educational Publishers, New Delhi.
4.Philip Kotler, Kevin L.K, Swee H.A, Chin T.T, Siew M.L,2018. Marketing Management: An Asian Perspective, Pearson Education Ltd, UK.
5.Gittinger,J.P., 1982. Economic analysis of agricultural projects. The John Hopkins University Press, Baltimore, USA.

E-References

1. www. management teacher.com
2. www.management.about.com

3. http:// managementhelp.org/
4. www.fma.org
5. http://www.ifmr.ac.in

23 AEC- 302 Intellectual Property Rights 1+0

OBJECTIVES:

1. To provide knowledge to students about basic concepts of Intellectual Property Rights
2. To explain its relevance and importance in WTO and Agriculture
3. To know the composition of IPR
4. To understand the protection of plant varieties and farmers rights
5. To study the biological diversity acts

Theory

Unit 1: Introduction IPR

Introduction and meaning of intellectual property, brief introduction to GATT, WTO,TRIPS and WIPO, Treaties for IPR protection: Madrid Protocol, Berne Convention, Budapest Treaty, etc.

Unit 2: Components of IPR

Types of IP and legislations covering IPR in India: Patents, copy rights, trademark, industrial design, geographical indication, integrated circuits and trade secrets.

Unit 3 : Acts of IPR

Patents Act 1970, Patent systems in India, patentability, process and product patent, filing of patent, patent specifications, patent claims, patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, patent search and patent database.

Unit 4 : **Protection of Plant varieties (PPV &FR)**

Origin, history including a brief introduction to UPOV for protection of plant varieties, protection of plant varieties under UPOV and PPV & FR Act of India, Plant Breedersrights, registration of plant varieties under PPV & FR Act 2001, breeders, researcher andfarmers rights. Traditional knowledge - meaning and rights of TK holders.

Unit 5: Convention of Biological Diversity

Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Lecture Schedule

1. Meaning, concepts and historical developments of Intellectual Property Rights.
2. Introduction to GATT, WTO, TRIPS and WIPO - role and importance
3. Treaties for IPR protection: Madrid Protocol, Berne Convention, Budapest Treaty, etc.
4. Types of IP and legislations covering IPR in India.
5. Patents, copy rights, trademark, industrial design,
6. Geographical indication and its importance, integrated circuits, trade secrets.
7. Patents Act 1970, Patent systems in India, patentability, process and product patent,

filing of patent.
8. Patent specifications, patent claims, patent opposition and revocation, infringement.
9. **Mid semester Examination**.
10. Compulsory licensing, Patent Cooperation Treaty, patent search and patent data base.
11. Origin, history including a brief introduction to UPOV.
12. Protection of plant varieties under UPOV and PPV & FR Act of India.
13. Plant Breeders rights, registration of plant varieties under PPV & FR Act 2001, breeders, researcher and farmers rights.
14. Traditional knowledge - meaning and rights of TK holders and IPR.
15. Convention on Biological Diversity, International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA),
16. Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.
17. Research collaborations in agriculture and role of IPR in protecting public institute inventions.

COURSE OUTCOMES:

CO1: Understand the impact of WTO in Agriculture
CO2: Understand the IPR acts in India
CO3: Understand the patent systems in India.
CO4: Understand the Protection of plant varieties under UPOV and PPV & FR ActofIndia
CO5: Know the features of biological diversity and benefit sharing

CO-POMAPPINGMATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	3	-	-	-
CO2	-	3	-	-	-	-
CO3	2	2	-	-	-	2
CO 4	-	-	2	-	-	-
CO5	-	1		1	-	-

References

1. Vinod V. Sople, 2014. Managing intellectual Property : The Strategic imperative. PHI Learning Private Limited , New Delhi.
2. Acharya, N.K, Textbook of Intellectual Property Rights, 2002. Asia Law House, Hyderabad.
3. Keith, E. Maskus,2000. Intellectual Property Rights in Global Economy, Institute forInternational Economics.
4. Jennewein, Klaus,2004, Intellectual Property Management, Springer Verlag , US
5. Ganguli P.,2001. Intelectual Property Rights : Unleashing Knowledge Economy, McGrawhill.

E-References:

1. https://www.rvskvv.net/images/INTELLECTUAL-PROPERTY-

RIGHTS_20.04.2020.pdf
2. https://www.smartzworld.com/notes/intellectual-property-rights-pdf-notes-ipr-pdf-notes/
3. https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_IPR_NOTES_0.pdf
4. https://www.annauniv.edu/ipr/files/downloadable/Overview%20of%20IPR.pdf
5. https://www.wto.org/english/tratop_e/trips_e/intel1_e.htm

23 EXT -301 COMMUNICATION SKILLS AND PERSONALITYDEVELOPMENT (1+1)

Learning Objectives

- To improve the knowledge level of the students on various communication skills
- To improve listening skills and develop presentation skills
- To gain knowledge on personality development and team building
- To enhance skill on various group techniques
- To facilitate the student on effective management of time and stress.

Theory

Unit I: Communication skills

Communication: Meaning & process of communication. Forms of communication: verbal & non-verbal -meaning. Communication skills: Meaning, hard & soft skills – over view, Verbal & non- verbal communication: Verbal: oral &written skills Non- verbal communication skills: Concept, meaning, forms & functions, importance of non- verbal communication incommunication.

Unit II: Listening & Presentation skills

Listening skill- meaning, concept, types of listening, barriers in listening & Note Taking, Oral presentation skills: impromptu presentation & extempore presentation, Effective Public Speaking.

Unit III: Group discussion & Techniques

Group discussion: Procedure, principles, purpose, advantages & disadvantages, Small groupdiscussion techniques: Panel. Symposium, buzz session, syndicate, conference, seminars, workshop, debate and lecture. Writing of technical articles, field diary & lab record, indexing, footnote &bibliographic procedures

Unit IV: Personality development & Team Building

Personality development: Meaning, definition & overview of personality traits, Questioning skills Attitude: Meaning, functions of attitude, developing positive attitude, Team building: working in team

Unit V: Time & Stress Management

Time management: Importance & role in personality development & time management Techniques, Conflict management: Meaning. Concept, causes of conflict & managing conflicts, Stress management: Meaning, definition, management of stress and current stream of thoughts.

Practicals

Simulation exercise to acquire various communication skills, Practical exercises - Group discussion, Panel discussion, Debate, Exercise on writing of technical articles, Identification ofpersonality types analysis of attitude & student feedback, Management games, Simulation exercise - time management, conflict management & Stress management. Creativity, acquisition of interview skills.

Lesson Plan

Theory Schedule

1. Communication: Meaning & process of communication. Forms of communication: verbal & non-verbal -meaning.
2. Communication skills: Meaning, hard & soft skills – over view
3. Verbal & non- verbal communication: Verbal: oral &written skills Non- verbal communicationskills: Concept, meaning, forms & functions, importance of non- verbal communication in communication
4. Listening skill- meaning, concept, types oflistening, barriers in listening & Note Taking
5. Oral presentation skills: impromptu presentation & extempore presentation

6. Effective Public Speaking
7. Group discussion: Procedure, principles, purpose, advantages & disadvantages
8. Small group discussion techniques: Panel. Symposium, buzz session, syndicate, conference, seminars, workshop, debate and lecture
9. **Mid Semester Examination**
10. Writing of technical articles, field diary & lab record, indexing, footnote & bibliographic procedures
11. Personality development: Meaning, definition & overview of personality traits
12. Questioning skills
13. Attitude: Meaning, functions of attitude, developing positive attitude
14. Team building: working in team
15. Time management: Importance & role in personality development & time management Techniques
16. Conflict management: Meaning. Concept, causes of conflict & managing conflicts
17. Stress management: Meaning, definition, management of stress and current stream of thoughts.

Practical Schedule

1. Simulation exercise for non- verbal communication& students feedback
2. Listening & note taking & student feed back
3. Exercise on reading & comprehension & students feedback
4. Group discussion – Practical exercises
5. Panel discussion – Practical exercises
6. Debate – Practical exercises
7. Exercise on writing of technical articles& students feedback
8. Identification of personality types- role play & psychological tests & students feedback
9. Identification of personality types- role play & psychological tests & students feedback
10. Attitude-Role play- analysis of attitude & student feedback
11. Working in learners- management games
12. Simulation exercise on time management
13. Simulation exercise on conflict management
14. Interview Skills – Mock interviews
15. Simulation exercise on creativity
16. Simulation exercise on physical and mental stress.
17. **Practical Examination**

Course Outcome

At the end of the course students will be able to
CO 1: Organize and conduct of various group techniques
CO 2: Students will be able to acquire various personality traits
CO 3: Develop hard and soft skills
CO 4: Gain knowledge on conflict management
CO 5: Acquire skill on public speaking

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO 5	1	1	3	0	0	3

References

1. Sanjay Kumar, 2011. Communication Skills. Oxford Publication.
2. Ray G L, 1991. Extension Communication and Management, Naya Prakasham, Kolkata.

3. Barun K. Mitra, 2011. Personality Development and Soft skills. Oxford Publication.
4. S.P. Sharma, 2013. A Youngsters‘ guide to personality development. V &S PublishersDelhi
5. Sagar mondal, 2020. Communication skills and personality Development, Kalyan Publishers.

e-resources

1. https://ecourseonline.iasri.res.in
2. https://www.iaritoppers.com
3. https://www.agrimoon.com
4. https://www.jnkvv.org
5. https://www.aau.in

23 COM 301 AGRI INFORMATICS (1+1)

Learning objectives

- Give students an in-depth understanding of why computers are essential components in business, education and society.
- Introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of computer hardware and software, the Internet, networking and mobile computing.
- Provide hands-on use of Microsoft Office applications Word, Excel, Access andPowerPoint. Completion of the assignments will result in MS Office applications knowledge and skills.
- To get familiar with basics of the Internet Programming.

Theory

Unit I: Introduction to Computers:

Introduction to Computers, Definition, Advantages & Limitations Anatomy of Computers – Components of Computers and its functions - Overview of Input devices of Computer Memory concepts, Units of memory - Operating System Definition and Types of operating systems.

Unit II: Microsoft Office:

MSWORD: Creating, Editing, Formatting a document and saving a document – Features ofFile, Edit and Format menus.

MSEXCEL: Data Presentation, Data presentation, interpretation and graph creation -Statistical analysis, mathematical expressions with MSEXCEL

MSACCESS: Database, concepts and types - Uses of DBMS in Agriculture; creatingdatabase.

Unit III: Internet& Programming Languages:

Internet - World Wide Web (WWW): Concepts and components - Programming Languages: Introduction to different computer programming languages - Programming Languages: Concepts and standard input/output operations.

Unit IV: E-Agriculture:

E-Agriculture, concepts and applications, Use of ICT in Agriculture - IT application: Computer-controlled devices (automated systems) for Agri-input management - Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc;

Unit V: Applications in Agriculture:

Decision support systems, concepts, components and applications in Agriculture, AgricultureExpert System, Soil Information Systems etc for supporting Farm decisions.

Lesson plan

Theory Schedule

1. Introduction to Computers, Anatomy of Computers.
2. Input and Output devices, Units of memory, Hardware, Software and Classification of Computers.
3. Memory concepts
4. Operating System, Types of operating system.
5. Booting sequence of operating system, DOS, Windows, Unix, VIRUS.

6. MS Office word, Creating, Editing, Formatting a document and Saving a document.
7. MS Excel Data Presentation, Data presentation, interpretation and graph creation.,
8. MS Access Concepts of Database, Creating Database.
9. Internet - World Wide Web (WWW)
10. **Mid Semester Examination**
11. Programming Languages, Computer programming languages.
12. e-Agriculture.
13. ICT in Agriculture.
14. IT application.
15. Smartphone Apps in Agriculture.
16. Applications in Agriculture.

Practical schedule

1. Study of Computer Components and accessories– Booting of Computer and its ShutDown.
2. Practice of some fundamental DOS commands – TIME, DATE, DIR, MD, CD, RD, DEL, TREE, COPY, VOL and LABEL.
3. Introduction of different operating systems such as windows, Unix, Linux.
4. Practicing WINDOWS Operating System – Use of Mouse, Title Bar, Minimise, Maximumand Close Buttons, Scroll Bars, Menus and Tool Bars, Creating Folders, COPY and PASTE functions and File Management.
5. MSWORD – creating, editing and presenting a scientific Document.
6. MS POWER POINT – creating, editing and presenting a scientific Document.
7. MSEXCEL: Creating a spreadsheet, writing expressions, Entering formula expressionthrough the formula tool bar and use of inbuilt statistical, mathematical functions.
8. MSEXCEL: creating graphs, analysis of scientific data-Data analysis-t-test, Regression, ANOVA.
9. MSACCESS: Creating Database, preparing queries and reports.
10. MSACCESS: Demonstration of Agri-information system.
11. Introduction to World Wide Web (WWW) and its components.
12. Introduction of programming languages.
13. HTML: Creation of scientific website.
14. Internet: Presentation and management agricultural information through web.
15. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost.
16. Introduction of Geospatial Technology for generating valuable information for Agriculture.

Course Outcome

At the end of the course students will be able to

CO 1: Describe the usage of computers and why computers in society.
CO2: Analyse common business problems using appropriate
CO 3: Learn categories of programs.
CO 4: system software and applications.
CO 5: Information Technology applications and systems.

CO - PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	3	0	0	3
CO2	0	1	3	1	1	3
CO3	1	1	3	1	0	3
CO4	0	0	3	0	1	3
CO5	1	1	3	0	0	3

References

1. Satish Jain, M Geetha, Kratika, (2012) Computer Course Windows 7 With Ms Office 2010,Bpb Publications.
2. Anupama Jain and Avneet Mehra (2012), Computer Fundamental MS Office: IncludingInternet & Web Technology 2010.
3. Meera SN 2008 ICTs in agricultural extension: Tactical to practical.
4. Willem Zip 1994 Improving the transfer and use of agricultural information: A guide to information technology.
5. Programming in Ansi C Paperback – 8 May 2012, by E Balagurusamy (Author).

e-resources

1. https://www.tutorialspoint.com/computer_fundamentals/index.htm.
2. https://vikaspedia.in/education/digital-litercy/it-literacy-courses-in-associating-with-msup/computer-fundamentals.
3. https://www.shobhituniversity.ac.in/caigers/caigers-course.php.
4. https://ecourses.icar.gov.in/.
5. https://www.kisangates.com/agro-informatics.html.

23 ECPAT 302 ANTAGONISTIC FORMULATIONS (2+1)

Learning objectives

- To study about biological control and its significance.
- To study mechanisms of action of antagonistic organisms.
- To study about factors governing biological control
- To study aout commercial production of antagonistic formulations
- To study about the delivery systems of antagonists and management of soil borne andfoliar diseases.

Theory

Unit I

History and concepts of biological control, significance, merits and demerits of disease management with antagonists- antagonistic organisms- mycorrhizal associations, suppressiveand conductive soils – general and specific suppression.

Unit II

Mechanisms of actions of antagonistic organisms and its relevance in biological control competition, antibiosis, lysis, hyper parasitism and Induced Systemic Resistance - ISR-SAR - rhizosphere colonization, competitive saprophytic ability, hypovirulence.

Unit III

Factors governing biological management of crop diseases, role of physical environment, agroecosystem, and cultural practices in biological control of pathogens- Soil fungistasis, influence of root exudates on establishment of antagonists – Effect of agrochemicals and fertilizers on antagonists – comparative approaches to biological control of plant pathogens byresident and introduced antagonists.

Unit IV

Commercial production of antagonists. Antagonists available in market. Quality control system of biocontrol agents.

Unit V

Delivery systems of antagonists, special methods of delivery systems - Control of soil-borne and foliar diseases. Compatibility of bioagents with agrochemicals and other antagonistic microbes.

Lesson plan

Theory schedule

1. Introduction of biological control
2. Important milestones of biological disease management
3. Concepts of biological disease management using antagonists

4. Merits and demerits of biological control
5. Suppressive and conductive soils
6. Mode of action of fungal antagonists
7. Mode of action of bacterial antagonists
8. Factors affecting antagonistic organisms
9. Influence of soil moisture, temperature and soil pH on growth of antagonists
10. Isolation and identification of fungal antagonists
11. Isolation and identification of bacterial antagonists
12. Estimation of fungal antagonists potential in soil
13. Estimation of bacterial antagonists potential in soil
14. Competitive saprophytic ability
15. Soil fungistasis
16. Influence of root exudates on establishment of antagonists
17. **Mid semester examination**
18. Mass multiplication of fungal antagonists
19. Mass multiplication of bacterial antagonists
20. VAM Fungi
21. Identification of carrier materials for formulation for fungal antagonists
22. Identification of carrier materials for formulation for bacterial antagonists
23. Methodology for formulation of fungal antagonists
24. Methodology for formulation of bacterial antagonists
25. Assessment of shelf-life period of antagonists
26. Different methods of storage systems for antagonists
27. Assessment of quality control of antagonists
28. Delivery system of fungal antagonists
29. Delivery system of bacterial antagonists
30. Special methods of antagonists application
31. Commercial formulation of biocontrol agent
32. Commercial formulation of biocontrol agent
33. Antagonists formulations available in market
34. Compatibility of bioagents with agrochemicals and other antagonistic microbes.

Practicals

Rhizophere soil – isolation and assessment of antagonists – methods of testing in vitroantagonism – assay of competitive saprophytic ability, antibiotics production, siderophores production– isolation of mychorriza and establishing its biocontrol potentiality – compatibility of agrochemicals with bio inoculants

Practical schedule

1. Isolation of fungal antagonistic organisms from rhizosphere soil
2. Isolation of bacterial antagonistic organisms from rhizosphere soil
3. Purification of fungal antagonistic organisms
4. Purification of bacterial antagonistic organisms
5. Methods of testing in vitro antagonism
6. Methods of testing in vitro antagonism
7. Assay of competitive saprophytic ability
8. Mass multiplication of *Trichoderma*
9. Mass multiplication of *Pseudomonas*
10. Mass multiplication of *Bacillus*
11. Mass multiplication of VAM fungi
12. Preparation of different formulations of selected antagonistic organisms

13. Quality parameters of antagonistic organisms
14. Application of antagonists against pathogen in vitro and in vivo conditions
15. Delivery systems of antagonist
16. Compatibility of agrochemicals with bio inoculants
17. Record certification

Course outcome

CO 1: Gain knowledge on concepts of biological control and its significance.
CO 2: Gain knowledge on operational mechanisms and its relevance in biological control.
CO 3: Gain knowledge on factors governing biological control.
CO 4: Gain knowledge on formulations of antagonistic organisms against diseases.
CO 5: Gain knowledge on Commercial production of antagonists and their delivery systems

CO –PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	1	3	2	2	-
CO 2	1	1	3	2	2	-
CO 3	1	1	3	2	2	-
CO 4	1	1	3	2	3	-
CO 5	1	1	3	2	2	-

References

1. Jean-Michel Merillon and Kishan Gopal Ramawat. 2020. Plant Defence: Biological Control. Springer.
2. Campbell R. 1989. Biological Control of Microbial Plant Pathogens. Cambridge Univ. Press, Cambridge.
3. Gnanamanickam SS (Eds). 2002. Biological Control of Crop Diseases. CRC Press, Florida.
4. Pratibha Sharma 2014. Biological Control of Plant Diseases and Weeds. 2014. ICAR Publications. Delhi, India.
5. Pandey R.N., Chakraborty B.N., Dinesh Singh and Pratibha Sharma. 2018. Microbial antagonists. Role in Biological control of Plant diseases. Part – 1 Fungal antagonists.Indian Phytopathological Society / Todays and Tomorrow Publishers.

e-resources

1. https://www.apsnet.org/edcenter/advanced/topics/Pages/BiologicalControl.asp
2. http://www.arc.agric.za/arcppri/Leaflets%20Library/Principles%20of%20 biological%20 controls.pdf
3. Fungi vs. Fungi in Biocontrol: An Overview of Fungal ...https://www.frontiersin.org › fcimb.2020.604923 › full
4. https://doi.org/10.3390/microorganisms8071037
5. https://doi.org/10.1016/j.sjbs.2019.05.004

23 ECAGM 301 BIOPESTICIDES AND BIOFERTILIZERS (2+1)

Learning Objectives

- To know the concepts and potential of biopesticides and biofertilizers
- To acquire the basic knowledge about the biofertilizers and biopesticides.
- To impart knowledge on theoretical and practical aspects of biopesticides and biofertilizers production and usage.
- To understand and develop skills about the production technology of biopesticides and biofertilizers
- To create awareness about the importance of biopesticides and biofertilizers in sustainablecrop production**.**

Theory

Unit 1: HISTORY AND DEVELOPMENT OF BIOPESTICIDES.

History and concept of biopesticides, importance-scope and potential of biopesticides, Definition, concept and classification of biopesticides viz., entomopathogens, Botanical pesticides. Botanicals and their uses.

Unit 2: MASS PRODUCTION OF BIOPESTICIDES.

Mass production technology of biopesticides-virulence-pathogenicity and symptoms of entomopathogens-biocontrol of nematodes- uses of biopesticides-method of application of biopesticides. Quality control and limitations in production

Unit 3: IMPORTANCE OF BIOFERTILIZERS

Biofertilizer-Introduction, scope, concept and development. Characteristic features of bacterial biofertilizers, *Azospirillum, Azotobacter, Pseudomonas, Rhizobium* and *Frankia* -Fungal biofertilizers-current scenario-list of cyanobacterial biofertilizers- Anabaena, Nostoc- AM mycorrhiza and ectomycorrhiza

Unit 4: MASS PRODUCTION OF BIOFERTILIZER.

Phosphate solubilizing biofertilizer. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology- strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers.

Unit 5: FORMULATIONS AND DELIVERY SYSTEM OF BIOFERTILIZERS

Formulation–types–carrier based and liquid inoculants. Equipment's–tangential flow filtration (TFF)-centrifugation-freeze drying. Application technologies- dosage, method and time of application of biofertilizers for different crops. FCO specifications and quality control of biofertilizers.

Practicals

Isolation and purification of important biopesticides. *Trichoderma, Pseudomonas Bacillus, Metarhizium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in near by area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities field condition. Quality control of biopesticides.

Isolation and purification of *Azospirillum, Azotobacter, Rhizobium*, P-Solubilizers andcyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi wet sieving method and sucrose gradient method. Mass production of AM inoculants.

Lesson Plan

Theory Lecture Schedule

1. History and concept of biopesticides
2. Importance of biopesticides
3. Classification of biopesticides.
4. Botanical pesticides and their uses.
5. Mass production technology of biopesticides
6. Virulence and Pathogenicity of biopesticides
7. Symptoms of entomopathogens
8. Biocontrol of nematodes.
9. Microbial management of pests.
10. Mode of entry and mode of action biopesticides.Uses of biopesticides

11. Method of application of biopesticides.
12. Quality control of biopesticides
13. Limitations in biopesticides production.
14. Introduction to biofertilizer.
15. Scope and development of biofertilizers.
16. Bacterial biofertilizers.
17. **Mid semester Examination.**
18. Current scenario of biofertilizers
19. Algal biofertilizers.
20. Fungal biofertilizers
21. Phosphate solubilizing biofertilizers.
22. Potassium releasing biofertilizers and their mechanism
23. Production technology of biofertilizers.
24. Strain selection
25. Sterilization, growth media and fermentation.
26. Formulations in biofertilizers
27. Techniques in carrier and liquid based biofertilizers.
28. Equipment's in biofertilizer production.
29. Equipment'stangential flow filtration (TFF) centrifugation-freeze drying.
30. Method of application of biofertilizers.
31. Dosage and time of application of biofertilizers for different crops.
32. FCO specifications of biofertilizers
33. Quality control of biofertilizers.
34. Preparation of biofertilizers projects

Practical Schedule

1. Isolation and purification of *Trichoderma sp.*
2. Isolation and purification of *Pseudomonas* and *Bacillus sp*.
3. Isolation and purification of *Beauveria bassiana*.
4. Isolation and purification of Metarhizium
5. Identification of important botanicals.
6. Visit to biopesticide laboratory in nearby area.
7. Field visit to explore naturally infected cadavers.
8. Identification of entomopathogenic entities in field condition.
9. Quality control of biopesticides.
10. Isolation and purification of *Azospirillum*,
11. Isolation and purification of *Azotobacter*,
12. Isolation and purification of *Rhizobium*,
13. Isolation and purification of P-solubilizers.
14. Mass production of bacterial biofertilizers.
15. Isolation of AM fungi – wet sieving method.
16. Mass production of AM inoculants.
17. **Final practical Examination**.

Course outcome:

CO 1: They will understand about the fundamental aspects, history,concepts, importance-scope and potential of biopesticides.

CO 2: They will acquire basic knowledge in mass production technology and quality control of biopesticides

CO 3: Students will gain knowledge on individual characteristics features of bacterial andfungal biofertilizers.

CO 4: Students will study and have practical knowledge of mass production of biofertilizers.
CO 5: Students will study and understand the recent biofertilizer formulations and qualitycontrol of biofertilizers

CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	**2**	**-**	**1**	**1**	**1**
CO2	**3**	**1**	**-**	**2**	**3**
CO3	**1**	**-**	**3**	**1**	**2**
CO4	**-**	**2**	**2**	**-**	**-**
CO5	**1**	**2**	**3**	**2**	**1**

Reference

1. Acharya, K. Surjith Sen and Manjula Rai. 2019. Biofertilizers and Biopesticides Technoworld.
2. Chanda J. K. 2008. Biofertilizer Statistics 2006-07. The fertilizer Association of India, NewDelhi.
3. DeshMukh, AM, R.M. Khobragade and P.P. Dixit 2007. Handbook of Biofertilizers and Biopesticides. Oxford Book Company, Jaipur, India.
4. Gupta R.P., AnuKalia and Shammi Kapoor 2007. Bioinoculants a step towards Sustainable Agriculture, NIPA, New Delhi
5. Somani L.L. P, Shilkar& D. Shilpkar 2011. Biofertilizers Commercial Production Technology& Quality control. Agro Publishing Acadamy, Udaipur.

e-resources

1. www.geocites.com
2. www.insectariumvirtual.com
3. www.nabard.org
4. http://www.greenpeace.org
5. www.hortsorb.com

23 ECGPB 302 - COMMERCIAL PLANT BREEDING (2+1)

Learning objectives

- To expose the students to learn basic and applied principles of plant breeding.
- To help the students to understand the quality seed production of hybrids.
- To learn post harvest seed handling techniques.
- To impart knowledge on seed quality testing and marketing.
- To know the importance of seed certification.

Theory

Unit I: Reproductive systems in crop plants

Objectives and role of plant breeding - modes of reproduction - sexual and asexual - self and cross pollination - significance of fertilization. Self incompatability – classifications - mechanisms - application – measures to overcome and limitations. Male sterility systems – Introduction and classification – GMS, CMS and CGMS – inheritance and application- TGMS, PGMS, Gametocides, Transgenic male sterility and applications - Alternative methods: production of haploids and Tissue culture techniques- Biotechnological tools.

Unit II: Hybrid Seed Production

Advances in hybrid seed production of self and cross pollinated crops - rice, maize, sorghum, pearl millet, red gram, sunflower, sesame, castor, brassica, cotton and vegetables.

Unit III: Post harvest seed handling techniques

Seed drying - seed processing - importance - seed cleaning and grading - seed quality enhancement – Seed packaging and storage.

Unit IV: Seed quality testing and marketing

Seed quality assessment – genetic purity test - molecular markers. Seed marketing-policies and demand.

Unit V: Seed legislation and certification

Importance of seed quality regulation-seed act and rules – seeds control order 1983 and New Seed Bill, 2004 and seed labelling-IPR issues in commercial plant breeding. DUS testing – registration of varieties under PPV & FR Act. Seed certification – varietal release and notification systems in India.

Practicals

Pollination and reproduction methods in crop plants - Emasculation and pollination techniques in self and cross pollinated crops – Hybrid seed production techniques in self and cross pollinated crops using A/B/R and two line systems – Hybrid seed production techniques in cereals, pulses, oilseeds, fibre and vegetable crops – Seed drying and storage structures in quality seed management – Seed quality assessment test – Seed quality enhancementtechniques – PPV & FR Act and IPR issues in commercial plant breeding.

Lesson Plan

Theory Lecture Schedule

1. Objectives of plant breeding – modes of plant reproduction.
2. Classification of crops based on pollination.
3. Self – incompatability – classification – mechanisms – applications.
4. Male sterility – classifications – CMS, GMS and CGMS systems in self and crosspollinated crops.
5. Two line breeding systems in self and cross pollinated crops.
6. Alternative strategies for the development of the line and cultivars: Haploid inducer andtissue culture techniques.
7. Alternative strategies for the development of the line and cultivars: Biotechnological tools.
8. Advances in hybrid seed production of rice.
9. Advances in hybrid seed production of maize.
10. Advances in hybrid seed production of sorghum.
11. Advances in hybrid seed production of pearl millet.
12. Advances in hybrid seed production of redgram.
13. Advances in hybrid seed production of sunflower.
14. Advances in hybrid seed production of sesame.
15. Advances in hybrid seed production of castor.
16. Advances in hybrid seed production of brassica.
17. **Mid semester examination**
18. Advances in hybrid seed production of cotton.
19. Advances in hybrid seed production of vegetables.
20. Seed drying, seed processing – importance.
21. Seed cleaning and grading.
22. Seed quality enhancement techniques.
23. Seed packaging and storage.
24. Seed quality assessment – genetic purity test and molecular markers.
25. Seed marketing – structure and organization.
26. Seed demand and forecasting.
27. Importance of seed quality regulation – seed act and rules.
28. Importance of seed quality regulation – seed rules
29. Seed certification and labelling.
30. Seed control order, 1983
31. New Seed Bill, 2004.

32. IPR issues in commercial plant breeding.
33. DUS testing and registration of varieties under PPV and FR Act.
34. Varietal release and notification systems in India.

Practical Schedule

1. Pollination and reproduction in crop plants.
2. Emasculation and pollination techniques in various crops.
3. Techniques of seed production in self and cross pollinated crops using A, B, R and twoline systems.
4. Hybrid seed production techniques in cereals.
5. Hybrid seed production techniques in pulses.
6. Hybrid seed production techniques in oilseeds.
7. Hybrid seed production techniques in fibre.
8. Hybrid seed production techniques in vegetables.
9. Seed drying structures in quality seed management.
10. Seed storage structures in quality seed management.
11. Genetic purity test.
12. Varietal identification using molecular markers.
13. Seed quality enhancement techniques.
14. PPV & FR Act and IPR issues in commercial plant breeding.
15. Visit to seed production plot.
16. Visit to seed production plot.
17. **Final practical examination.**

Course outcome

CO 1: To enrich different types of male sterility system
CO 2: To provide knowledge on reproductive system in field and horticultural crops.
CO 3: Will acquire knowledge on hybrid seed production technologies for commercial seed production.
CO 4: Help to assess the seed quality and analyse the seed marketing.
CO 5: will know about seed rules, act and certification procedures to empower them tobecome entrepreneur.

CO – PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	2	1
CO2	3	2	3	2	3
CO3	2	3	2	1	2
CO4	1	2	3	2	1
CO5	3	1	2	3	2

References

1. Miller B. McDonald, Lawrence O. Copeland. 1997. Seed Production Principles and Practices.Springer, Boston, MA.
2. Hayward, M.D., N.O. Bosemark, I. Romagosa and M. Cerezo. 1993. Plant Breeding Principles and Prospects. Springer, Dordrecht.
3. Singh, B.D. 2009. Plant Breeding – Principles and Methods. Kalyani Publishers, NewDelhi.
4. George Acquabah. 2012. Principles of Plant and Breeding, John Wiley and Sons, NewDelhi.
5. Singhal, N.C. 2003. Hybrid seed production in Field crops, Kalyani Publishers, New Delhi.

e- resources:

1. https://www.agrimoon.com/wp-content/uploads/Principles-of-Plant-Breeding.pdf
2. www.sciencedirect.com
3. www.seednet.gov.in

4. www.agricoop.nic.in
5. www.onlinelibrary.willey

23 ECHOR 301- HI-TECH. HORTICULTURE 3 (2+1)

Learning objectives

- To impart knowledge on Modern Nursery techniques of Horticulture crops.
- To impart knowledge on the protected cultivation of horticultural crops.
- To sensitize the students on crop management of horticultural crops.
- To impart knowledge in precision horticultural techniques.
- To gain knowledge on mechanization in horticultural crops

Theory

Unit I: Modern Nursery techniques

Introduction & importance; Modern Nursery techniques –media- micro grafting, micro propagation of horticultural crops - Field preparation and planting methods.

Unit II: Protected Cultivation

Importance and methods of Protected Cultivation-Advantages, Climate control – Temperature,Relative Humidity, transpiration, ventilation – heating and cooling systems – Co2 enrichment –light regulation etc., methods and techniques- Micro irrigation systems and its components

Unit III: Crop Management

High density planting, UHDP, meadow orcharding, Canopy management-pollarding, rejuvenation of senile orchards, high density orcharding –Fertilization - EC, pH-based fertilizer scheduling, Leaf Nutrient analysis, nutrient deficiency symptoms and its remedy, water solublefertilizers-automation- mulch films-weed mat- hydroponics – NFT – aeroponics.

Unit IV: Precision Horticulture

Concept of Precision Horticulture: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), mobile mapping system and its application in precision farming – role of computers in developing comprehensive systems needed in site specific management (SSM) – IOT and AI Tools, geo referencing and photometric correction-Application in Horticultural crops.

Unit V: Mechanization in Horticulture

Mechanized seed sowing, grafting, transplanting- Mechanization in Pruning, tree pruners, Hedge trimmers, Brush cutters, Mowers, Mechanized sprayers - Drone sprayers, Aerial sprayers, Mechanization in harvesting – Fruit harvester, Tree shakers, washing units, Sizeand colour graders – Mechanization in Packaging, Corking, Bottling and Labelling and QR Coding and Bar coding and Mechanized supply chain management of produce etc. Current stream of Thoughts.

Practicals

Nursery techniques, Mat nursery, Protrays, Micro grafting, Micro propagation, planting systems, Types of protected chambers, poly house, shade house, mist chamber, low tunnel, climate control tools, Micro irrigation- Sprinklers, drippers, foggers etc., High density planting, UHDP, Pruning methods, Pollarding, Fertilization methods-water soluble forms, Leaf nutrient analysis, foliar vs soil application, hydroponics , remote sensing tools, GIS, DGPS, VRA and their application in Horticultural crops. Mechanized seed sowing, transplanting, pruning, spraying, harvesting, grading and labelling, QR and Bar coding etc.

Lesson Plan

Theory Schedule

1. Hi-tech culture- overview – global scenario of horticultural Crops.
2. Nursery technology poly-tunnels, types of benches and containers.
3. Different media for growing nursery.
4. Micro propagation of horticultural crops.
5. Modern field preparation and planting methods.

6. Protected Cultivation-Advantages of Protected cultivation, various chambers.
7. Climate control - methods and techniques.
8. Micro irrigation systems and its components.
9. HDP, UHDP, Meadow Orcharding.
10. EC & PH based fertilizer scheduling -Water soluble fertilizers.
11. Weed management and weed mat.
12. Hydroponics and Aeroponics
13. Mid semester Examination
14. Precision horticulture, Principles and concepts,
15. Remote sensing and Robotics
16. Geographical Information System (GIS) and its application.
17. Differential Geo-positioning System (DGPS).
18. Variable Rate applicator (VRA).
19. Role of IOT and AI in Horticulture crops
20. Precision equipment's, computers and robotics in precision farming.
21. Precision farming technology for Horticultural crops.
22. Mechanized seed sowing and grafting
23. Pruning equipment's, trimmers, brush cutters and mowers
24. Modern spraying methods-Drones, aerial sprayers.
25. Mechanization in harvesting -Fruit harvester, Tree shaker.
26. Computerized Graders-Size and colour sensors.
27. Mechanized packaging units.
28. Bottling and corking methods.
29. QR and Bar coding – Role, Importance and methods

Practical Schedule

1. Modern techniques of nursery production.
2. Media and Micro propagation methods.
3. Micro grafting methods and its advantages.
4. Different Types of Protected structures.
5. Climate control in Poly- house-Concepts and Techniques.
6. Micro Irrigation Methods-Design, layout and installation methods.
8. HDP and UHDP –Advantages and its Application in modern orchards.
9. Leaf Nutrient analysis, EC, PH based fertilizer scheduling.
10. Nutrient Deficiency symptoms –its cause and remedy
11. Weed management-weed mat
12. Remote sensing - Role of GIS, DGPS, VRA etc.
13. IOT and AI in horticultural crops
14. Mechanized seed sowing, grafting, transplanting
15. Mechanization in Pruning, tree pruners, Hedge trimmers, Brush cutters, Mowers
16. Mechanized sprayers, Harvesting and Packaging methods
17. Practical Examination.

Course Outcome:

CO 1: The students will acquire knowledge on the Modern Techniques in NurseryTechnologies.
CO 2: The students will be gaining knowledge on Protected cultivation of Horticultural crops.
CO 3: Students will be able to understand and acquire knowledge on Canopy managementand crop management techniques.
CO 4: Students will be able to gain knowledge on Precision Horticulture.CO 5:
The students will know about the Mechanization in Horticulture.

CO-PO Mapping matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	2	2	2	0
CO 2	3	3	2	2	2	2
CO 3	3	3	2	2	2	2
CO 4	3	3	2	2	2	2
CO 5	3	0	2	2	2	3

References

1. Peter, K.V. S. Rajan and Baby Lissy Markose. 2007. *Propagation of Horticultural Crops. Horticulture Science Series-6*. New India Publishing Agency,Pitam Pura, New Delhi
2. Srivastava, K K. 2007.Canopy Management of Fruit Crops.International Book Distributing company.
3. Tiwari, G.N. 2003. Green House Technology for Controlled Environment. Narosa Publ.House
4. Jitendra Singh, S.K. Jain and L.K. Dashora. 2013.Precision Farming in Horticulture. NewIndia Publishing Agencies
5. S.C. Mandhar, 2014, Mechanization in Horticulture. Astral Publishing Co

e-resources:

1. http://www.informaworld.com/smpp/title~db=all~content=g904622674
2. http://www.ces.ncsu.edu/depts/hort/hil/hil-32-a.html
3. http://attra.ncat.org/attra-pub/manures.html
4. http://ucanr.org/freepubs/docs/8129.pdf
5. https://www.yumpu.com/en/document/read/16839007/canopy-management-in-fruit-crops-department-of-agriculture-co-

23IKS201 INDIAN KNOWLEDGE SYSTEM 2(1+1)

Course Objectives:

The course design seeks to address the following issues:

• To introduce to the students the overall organization of IKS

• To develop an appreciation among the students the role and importance of Veda, Vedāṅgas, Upa Vedas and Purāṇas

• To show case the multi-dimensional nature of IKS and their importance in the contemporary society • To motivate the students to take up a detailed study of some of these topics and explore their application potential

Course Outcomes:

CO1: Explain the historicity of Indian Knowledge System and the broad classification of Indian philosophical systems

CO2: Explain the potential of Sanskrit in natural language processing

CO3: Explain the features of Indian numeral system and its role in science & technology advancement

CO4: Illustrate the basic elements of the Indian calendar and the components of Indian Panchanga

CO5: Outline the science, engineering & technology heritage of ancient and medieval India

Syllabus

Unit I: Introduction to Indian Knowledge System (IKS), Definition, Concept and Scope of IKS (4)

Definition, Concept and Scope of IKS
IKS based approaches on Knowledge Paradigms
IKS in ancient India and in modern India

Unit II: IKS and Indian Scholars, Indian Literature (8)

1. Philosophy and Literature (Maharishi Vyas, Manu, Kanad, Pingala, Parasar, Banabhatta, Nagarjuna and Panini)
2. Mathematics and Astronomy (Aryabhatta, Mahaviracharya, Bodhayan, Bhashkaracharya, Varahamihira and Brahmgupta)
3. Medicine and Yoga (Charak, Susruta, Maharishi Patanjali and Dhanwantri)
4. Sahitya (Vedas, Upvedas, Upavedas (Ayurveda, Dhanurveda, Gandharvaveda)
5. Puran and Upnishad) and shad darshan (Vedanta, Nyaya.Vaisheshik, Sankhya, Mimamsa, Yoga, Adhyatma and Meditation)
6. Shastra (Nyaya, vyakarana, Krishi, Shilp, Vastu, Natya and Sangeet)

Unit III: Indian Traditional/tribal/ethnic communities, their livelihood and local wisdom (6)

1. Geophysical aspects, Resources and Vulnerability
2. Resource availability, utilization pattern and limitations
3. Socio-Cultural linkages with Traditional Knowledge System
4. Tangible and intangible cultural heritage.

Unit IV: Unique Traditional Practices and Applied Traditional Knowledge (8)

1. Myths, Rituals, Spirituals, Taboos and Belief System, Folk Stories, Songs, Proverbs, Dance, Play, Acts and Traditional Narratives
2. Agriculture, animal husbandry, Forest, Sacred Groves, Water Mills, Sacred Water Bodies, Land, water and Soil Conservation and management Practices
3. Indigenous Bio-resource Conservation, Utilization Practices and Food Preservation Methods, Handicrafts, Wood Processing and Carving, -Fiber Extraction and Costumes
4. Vaidya (traditional health care system), Tantra-Mantra, Amchi Medicine System
5. Knowledge of dyeing, chemistry of dyes, pigments and chemicals

Unit V: Protection, preservation, conservation and Management of Indian Knowledge System (4)

1. Documentation and Preservation of IKS
2. Approaches for conservation and Management of nature and bio-resources
3. Approaches and strategies to protection and conservation of IKS

V Semester

23 AGR 303 FARMING SYSTEMS AND ORGANIC FARMING FOR SUSTAINABLE AGRICULTURE (2+1)

Learning objectives

- Aims at incurring knowledge on various aspects of organic farming and its importance inpresent world scenario and its impact on environment and soil health
- To impart knowledge on varied farming enterprises and their integration for sustainable productivity
- Students will gain knowledge about organic inputs for sustainable agriculture
- To develop skills on managing farm resource and improving nutritional standards for betterment of health
- Students will get exposure on innovative organic farm products and certification

Theory

Unit I: Farming System

Farming System-scope, importance, and concept. Types and systems of farming system and factors affecting types of farming. Farming system components and their maintenance. Interaction between different enterprises with cropping – scope and advantages of integrated farming system – Integrated farming system models for different agro eco – systems. Indices for evaluation of farming systems.

Unit II: Cropping system

Cropping system – definition, principles, concepts, various types of cropping systems. Interactions between different cropping systems. Cropping scheme – determinants – principles. Efficient cropping system and their evaluation. Allied enterprises and their importance. Tools for determining production and efficiencies in cropping and farming system

Unit III: Resource Management

Sustainable agriculture-problems and its impact on agriculture - indicators of sustainability - adaptation and mitigation. Conservation agriculture strategies in agriculture - HEIA, LEIA and LEISA and its techniques for sustainability. Resource use efficiency and optimization techniques - Crop residue management, resource management under constraint situations. Resource cycling and flow of energy in different farming system and environment.

Unit IV: Organic farming for sustainable Agriculture

Organic farming- concepts, principles and its scope in India- organic ecosystem and their concepts. Organic nutrient resources and its fortification. Restrictions to nutrient use in organicfarming. Choice of crops and varieties in organic farming. Organic waste recycling methods. Indigenous Technical Knowledge (ITK) in organic agriculture. Fundamentals of insect, pest, disease and weed management under organic mode of production.

Unit V: Organic certification and Labelling

Operational structure of NPOP - Certification process and standards of organic farming.Processing – labelling – economic considerations and viability - marketing and export potential of organic products-Initiatives taken by Government (central/state) - NGOs and otherorganizations for promotion of organic agriculture. Current stream of thoughts.

Practicals

Visit of IFS model in different agro-climatic zones of nearby state university/ institutes and farmer's field. Visit of organic farms to study the various components and their utilization. Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis. Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management. Cost of organic production system. Post harvest management- Quality aspect, grading, packaging and handling.

Lesson plan

Theory Schedule

1. Modern agriculture- problems and its impact on agriculture and resources – Sustainable agriculture
2. Indicators of sustainability- adaptation and mitigation.
3. Farming System-scope, importance, and concept – related terminology.
4. Types and systems of farming system and factors affecting types of farming.
5. Farming system- components and their importance and maintenance.
6. Cropping systems and patterns-multiple cropping system- Efficient cropping system andtheir evaluation.
7. Cropping scheme, principles and factors influencing cropping scheme competitive and complementary interactions in different cropping system (Light, water, nutrient and weed)
8. Integrated farming system-historical background-objectives and characteristics.
9. Components of IFS and its advantages - Site specific development of IFS model fordifferent agro-climatic zones in rainfed, irrigated and irrigated dry conditions
10. Allied enterprises and their importance - complementary and competitive interactions -Dairy, Sheep and Goat rearing – Aquaculture
11. Allied enterprises and their importance- complementary and competitive interactions-Poultry, Apiculture, Sericulture and Mushroom cultivation.
12. Tools for determining production and efficiencies in cropping and farming system.
13. Conservation agriculture - strategies – soil degradation, water availability, climate changeand its effect on agriculture, adaptation and mitigation
14. Management of natural resources -HEIA, LEIA and LEISA and its techniques forsustainability.
15. Resource use efficiency and optimization techniques - Resource cycling and flow ofenergy indifferent farming system.
16. Farming system and environment- Conservation of natural resources and maintenance of biodiversity.
17. **Mid semester Examination**
18. Organic farming- Definition- principles and its status and scope in India. Milestones inorganic farming movement in the World and in India - its comparison with conventional system.
19. Organic ecosystem and their concepts - Soil and water management- soil organic matterand humus- their physical, chemical and biological properties.
20. Choice of crops and varieties in organic farming – Conversion of soil to organic farming.
21. Organic nutrient management-types of organic manures - biofertilizers- efficient use oforganic sources of nutrients.
22. Organic waste recycling methods and techniques and ITK technology of organicagriculture and its importance
23. Organic nutrient resources and its fortification- Constraints of nutrient use in organicfarming.
24. Weed management in organic farming – cultural- mechanical- biological – bio herbicides.
25. Pest management in organic farming- different components – parasites- predators,microbial pesticides (Bio) -resistant varieties and pheromones.
26. Disease management in organic farming – cultural, mechanical, biological- bio fungicides.
27. Organic production package of important field crops- Rice, sorghum, finger millet, cotton, groundnut and soybean.
28. Operational structure of NPOP- Accreditation agencies in the World and India- Role of APEDA and IFOAM
29. Accreditation- standards- procedure of accreditation
30. Certification-Agencies/Organizations. – standards- procedure for certification.
31. Post- harvest - processing - labelling and sanitation procedures in organic farming.

32. Marketing and export potential of organic products- Opportunities and Constraints
33. Impact of organic farming on food security, environment and health.
34. Initiatives taken by Government (Central/State) - NGOs and other organizations forpromotion of organic agriculture and current stream of thoughts.

Practical Schedule

1. Components of organic ecosystem – soil, water, environment and biodiversity
2. Organic recycling – compost, coirpith compost, sugarcane trash compost
3. Vermicompost and enriched vermicompost methods from crop residues and organicwastes, production techniques, Grading, packaging and post- harvest packaging
4. Biofertilizers production techniques and its application methods
5. Preparation of neem products and other botanicals and their use for pest and diseasecontrol.
6. Indigenous technology knowledge (ITK) for nutrient and weed management
7. Indigenous technology knowledge (ITK) for pest and disease management
8. Study of quality parameters of organic products.
9. Visit to organic farm and cost economics of organic production system
10. Visit to organic farmer field.
11. Grading, labelling and packaging of organic products.
12. Visit to organic outlet
13. Visit to Agroforestry unit.
14. Working out of indices for evaluation of the cropping systems, land use, yield advantages, economic and sustainable
15. Visit to IFS unit in different agro-climatic zones of nearby states University/ institutes and farmers field.
16. Visit to Dairy unit/ Mulberry unit/ Poultry unit/ Mushroom unit
17. **Practical examination**

Course Outcome

CO 1: To gain the information and acquire practical knowledge on various types ofcropping systems.

CO 2: To understand interaction between different farm enterprises and to gain the information about the impact of organic farming and indigenous practices

CO 3: To understand the procedure followed for organic certification as per NPOP guidelines and to evaluate different resource management techniques in conservation agriculture.

CO 4: To know about : Low-cost input technologies for sustainable crop productionCO 5: To know about conservation agriculture strategies in agriculture

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	-	3	2	1
CO2	2	1	3	-	3	-
CO3	1	3	3	-	2	2
CO4	1	1	3	-	1	-
CO5	3	2	2	3	2	-

References

1. Dahama A. K. 2007. Organic Farming for Sustainable Agriculture, Agro Bios (India), Jodhpur.
2. Gehlot.D. 2012. Organic Farming – Standards, Accreditation, Certification and Inspection, Agribios(India) publishers, Jodhpur.
3. Joshi and Prabhakar Shetty T.K. 2006. Sustainability through Organic Farming. Mukund KalyaniPublishers Ludhiana.

4. Palaniappan, S P and Annadurai, K. 2008, Organic Farming: Theory and Practice-ScientificPublishers (India) Ltd., Jodhpur.
5. Jayanthi. C., Devasenapathy, P and C. Vennila. 2007. Farming systems, Principles andPractices. Sathish Serial publishing house, Delhi.

e-resources

1. http://www.navdanya.org/attachments/Organic-Farming3.pdf
2. http://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/PDF-downloads/TOFG-all.pdf
3. http://nsdl.niscair.res.in/123456789/670Revised Organic farming.pdf4. http://jnkvv.org/PDF/05042020134251342008 22.pdf.
5. https://www.coabnau.in/uploads/1609844393_Agron.5.6.pdf.

23 ENT 302 INSECT ECOLOGY AND INTEGRATED PEST MANAGEMENT (2+1)

Learning Objectives:

- To understand the basic ecological concepts in relation to insects
- To evaluate influence of abiotic and biotic factors in insect population dynamics and its relevance in Integrated Pest Management (IPM)
- To illustrate various components of IPM and their importance
- To discuss ecological perspectives of insecticides
- To illustrate use of sampling and AESA in pest management decision making

Theory

Unit I: Insect Ecology

Insect Ecology–introduction and definition- anecology, synecology, biome, population,community, niche, ecosystem and agro-ecosystem. Balance of life in nature - trophic level, food chain, food web. Population dynamics-J-shaped growth form, S-Shaped growth form, natality, mortality, dispersal, biotic potential and life table. Environmental resistance on insect population - abiotic factors and biotic factors. Pests – definition, categories, biotypes, losses and causes for outbreaks. Symptoms and nature of damage. Pest surveillance - sampling techniques and forecasting. Concepts of ETL and EIL.

Unit II: Integrated Pest Management and its Components

IPM - Introduction, definition, importance, limitations of IPM. Components of IPM – Cultural, Mechanical, Physical and Legal methods – invasive insect pests, Host plant resistance in IPM,Biological methods in IPM - classical biological control, merits and limitations of biological control, Parasitoids, Predators and Pathogens, difference between predator and parasitoid Types of parasitoids and parasitism, Important families of predators and parasitoids, Microbial control - groups of microbial agents and their actions on insects, Mass multiplication and application techniques of important groups of parasitoids, predators, pathogens and entomophilic nematodes. Conservation, importation, augmentation and release of bio control agents. Role of birds in insect and rodent management.

Unit III: Bio rational Pest Management Strategies

Semiochemicals in IPM – Pheromones, Allomones, Kairomones and Synomones and theirrole in pest management- Traps - Insect growth regulators in IPM – Moult inhibitors and JH mimics - Push and Pull techniques - Botanical insecticides in IPM – antifeedants and repellents. Formulation techniques of botanicals. Traditional methods in IPM, Biotechnology, Sterile male technique and gamma radiation in IPM.

Unit IV: Chemical methods of Insect Pest Management

Chemical control – importance and history. Classification of pesticides. Toxicity ranges – $LD_{50,}$ $LC_{50,}$ etc. Basic and newer formulations of insecticides. Handling hazards of insecticides - Symptoms of poisoning, first aid and antidotes, Compatibility and phytotoxicity. Newer insecticides in pest management.

Unit V: Ecological Perspectives of chemical methods and IPM Strategies for crops Insecticide residues, Insecticide resistance, Insect resurgence, Insecticide contamination andpollution, Bio accumulation and Bio magnification, Acute Chronic toxicity, Insecticideresistance and residue

management. Integrated pest management strategies in different cropecosystems – Rice, cotton, sugarcane, coconut, Brinjal and Mango. Current Stream ofdevelopments in Insect Ecology and IPM.

Practical

Studies on terrestrial/pond ecosystems. Types and symptoms of insect damage. Sampling techniques for the estimation of insect population and damage. Pest surveillance through light traps, pheromone traps and estimating field incidence. Practices in Cultural, Mechanical and Physical methods. Studies on distinguishing characters of resistant varieties. Traps in pest management. Identification of parasitoids, predators and entomopathogens. Mass culturing techniques of *Trichogramma, Chrysopa*and Coccinellids. Mass production of NPV and Fungal pathogens. Models of bird perches, owl nesting and placement. Identification of plants of insecticidal value. Preparation of Botanical formulations. Practices in Traditional methods of pest management. Different groups of pesticide formulations and label information.Precautions in pesticide applications - first aid and antidotes in case of insecticide poisoning. Pesticide application equipments – types and uses. Preparations of spray fluids for field application. Calculation of dose/concentration of insecticides. Compatibility of pesticides and phytotoxicity of insecticides. Effective application of insecticides.

Assignment: Each student has to submit at least 20 numbers of insect damaged plantspecimens (Herbarium) and ten insecticide labels.

Theory Lecture Schedule

1. Definition and importance of Insect ecology. Terminologies related to Insect ecology - anecology, synecology, biosphere, habit, habitat, biome, population, community, niche, ecosystem and agro-ecosystem.
2. Balance of life in nature - Trophic level- producers and consumers, food chain, food web. Population dynamics - J shaped and S Shaped growth form, Natality, Mortality-r strategists and K strategists, dispersal, biotic potential and Life table.
3. Effect of abiotic factors on insect population – temperature, moisture, humidity, rainfall, light, atmospheric pressure, air currents etc.
4. Effect of biotic factors on insect population– intra specific, inter specific relations.
5. Definition and categories of pests, biotypes and causes for pest outbreak. Symptoms and losses of pest attack. Sampling techniques, Surveillance and pest forecasting. Conceptsof Economic Injury Level (EIL) and Economic Threshold Level (ETL).
6. Definition of IPM. Concepts, Scope and limitations of IPM.
7. Definition and examples of Cultural, Physical and Mechanical methods of pest management
8. Host plant resistance – Definition, Types of Resistance-Ecological Resistance - Host evasion - Induced Resistance – Escape. Genetic Resistance - Monogenic-Oligogenic- Polygenic - Major gene - Minor gene. Vertical and Horizontal resistance. Pureline and Multiline resistance. Cross and Multiple resistance. Sympatric and Allopatric resistance.
9. Mechanisms of Host plant resistance – Antixenosis - Antibiosis – Tolerance. Compatibilityof HPR in IPM. Advantages and Disadvantages of HPR. Examples of resistant varieties inmajor crops.
10. Legal methods of pest control - Important provisions, Plant Quarantine, Insecticides Act 1968 – Invasive insect pest.
11. Biological methods- classical biological control, merits and limitations, Parasitoids and Predators – definition - difference between a predator and a parasitoid - Types of parasitoids - Types of parasitism.
12. Important families of predators and parasitoids and their role in pest management.
13. Microbial control – definition, Important groups of microbial agents, Mode of action and symptoms of pathogenicity. Their role in pest management.
14. Mass multiplication and application techniques of important groups of Parasitoids and Predators.
15. Mass multiplication and application techniques of important Entomopathogenic Viruses,

Bacteria, Fungi and nematodes.

16. Conservation, importation, augmentation and release of natural enemies. Role of birds ininsect and rodent management.
17. **Mid Semester Examination**
18. Pheromones in IPM – Sex pheromones, Alarm pheromones, trail pheromones andaggregation pheromones
19. Allelochemicals in IPM -Allomones, Kairomones and Synomones. Insect growthregulators in IPM – Moult inhibitors and JH mimics.
20. Traps in management of crop and storage pests. Push and Pull techniques.
21. Biotechnology in IPM – genetic engineering – transgenic crops – Constraints in using transgenic crops. Sterile male technique and gamma radiation in IPM.
22. Botanical insecticides in IPM – Neem and other examples. Antifeedant, Repellant andInsect growth disturbance properties of botanicals.
23. Formulation techniques of Botanicals.
24. Traditional methods in IPM.
25. Chemical control – importance and history.
26. Classification of pesticides – different modes of classification.
27. Toxicity ranges. Basic and newer Formulations of insecticides.
28. Hazards of insecticides - Symptoms of poisoning, first aid and antidotes.
29. Insecticide residues, insecticide resistance, Insect resurgence
30. Insecticide contamination and pollution, bio accumulation and bio magnification.Compatibility and Phytotoxicity.
31. Newer insecticides in pest management. Insecticide resistance and residue management.
32. Integrated pest management strategies for Rice and cotton, sugarcane and coconut.
33. Integrated pest management strategies for Sugarcane and Coconut
34. Integrated pest management strategies for Brinjal and Mango.

Practical Schedule

1. Characterization of terrestrial /pond ecosystems and preparation of charts.
2. Observation on types of damage and major symptoms caused by insect pests.
3. Practicing various sampling techniques and assessment of insect population and theirdamage in field/horticultural crops.
4. Practicing Pest surveillance through light traps/ pheromone traps and forecasting of field incidence.
5. Practicing common Cultural, Mechanical and Physical methods in pest management.
6. Analysing distinguishing characters of few resistance varieties of important crops.
7. Observation on models of traps in pest management – Pheromone traps, light traps,sticky traps and other traps.
8. Identification of different types of parasitoids, predators and entomopathogens.
9. Practicing Mass culturing techniques of *Trichogramma.*
10. Practicing Mass culturing techniques of *Chrysopa* and Coccinellids
11. Practicing Mass production of NPV and Fungal pathogens.
12. Studies on models of bird perches, owl nesting and placement. Preparation of Botanical formulations. Practicing few Traditional methods of pest management.
13. Identification of different groups of pesticide formulations.
14. Recognizing label information, Precautions in pesticide applications, First aid and antidotes information. Identification of types of Pesticide application equipments andpracticing of application of insecticides.
15. Preparations of spray fluids for field application. Calculation of doses/concentrations of insecticides.
16. Observation on compatibility of pesticides and Phytotoxicity of insecticides. Effectiveapplication of

insecticides.

17. Orientation for final examination

Course Outcome:

CO 1: Depict basic ecological concepts; understand the impact of ecology on the insect population and concepts of IPM, ETL and EIL.To employ AESA and pest survey aspest management decision making tools.

CO 2: Explain role of biological pest suppression and mass production of various biocontrol agents.

CO 3: Describe non chemical methods of pest management viz., bio rationals and othernovel techniques like sterile insect method.

CO 4: Discuss classification and formulations of insecticides, their poisoning effects and antidotes.

CO 5: Describe ill effects of over use of insecticides and define various IPM modules for different crops.

CO-PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	2	3
CO2	3	2	3	3	2	3
CO3	3	3	3	2	3	2
CO4	3	2	3	2	3	3
CO5	2	2	3	2	3	3

References

1. Dhaliwal, G.S. and Ramesh Arora. 1998. *Principles of Insect Pest Management.* Kalyani Publishers, New Delhi.395p.
2. Jain, P.C. and M.C. Bhargava. 2007. *Entomology – Novel approaches*. New India Publishing agency, New Delhi. 533 p.
3. Koul, O., G. S. Dhaliwal and G.W. Cuperus. 2004. *Integrated pest management: potential, constraints and challenges*, CABI Publishing Series, 329 p.
4. Rao,V., Umamaheswari and R. Prasad. 2010. *Integrated Insect Pest Management*. Agrobios, Jodhpur. 266p.
5. Srivastava, K.P. 2003. *A text book of Applied Entomology*. Vol. I and II. Kalyani Publishers. 257 p and 319p.

E-Resources

1. http://www.ncipm.org.in/recent-publications.htm
2. http://www.ipmnet.org
3. https://www.epa.gov
4. https://content.ces.ncsu.edu

23 PAT 303 PRINCIPLES OF INTEGRATED DISEASE MANAGEMENT (2+1)

Learning objectives

- To acquire knowledge on the history, economic importance and principles of IDM
- To learn the methods of detection, diagnosis and calculating economic injury level and economic threshold level of plant diseases
- To study the different principles of plant disease management with ecologicalmanagement of crop environment
- To acquire knowledge on plant disease survey, forecasting and development andvalidation of IDM module
- To acquaint with the safety issues in pesticide uses with political, social and legalimplication of

IDM.

Theory

Unit I

Categories of diseases, IDM: Introduction, history, importance, concepts, principles and toolsof IDM. Economic importance of diseases and pest risk analysis.

Unit II

Methods of detection and diagnosis of diseases. Calculation and dynamics of economic injury level and mportance of economic threshold level.

Unit III

Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the disease management.

Unit IV

Survey: surveillance and forecasting of diseases. Development and validation of IDM module. Implementation and impact of IDM and IDM module for disease.

Unit V

Safety issues in pesticide uses. Political, social and legal implication of IDM. Case histories of important IDM programmes.

Lesson plan

Theory schedule

1. Categories of plant diseases
2. Introduction of IDM
3. History of IDM
4. Importance of IDM
5. Concepts of IDM
6. Principles and tools of IDM
7. Economic importance of diseases and pest risk analysis
8. Methods of detection and diagnosis of diseases
9. Calculation and dynamics of economic injury level of plant diseases
10. Importance of economic threshold level of plant diseases
11. Introduction of principles of plant disease management
12. Host plant resistance
13. Cultural methods
14. Mechanical methods
15. Physical methods
16. Legislative methods
17. Mid semester examination
18. Biological methods
19. Mechanism of action of biocontrol agents
20. Chemical methods
21. Classification of fungicides
22. Mode of action and uses
23. Methods of application of fungicides
24. Ecological management of crop environment
25. Introduction to conventional pesticides for the disease management
26. Plant disease survey and surveillance
27. Plant disease forecasting
28. Development and validation of IDM module
29. Implementation and impact of IDM

30. IDM module for plant disease
31. Safety issues in pesticide uses
32. Political, social and legal implication of IDM
33. Case histories of important IDM programmes
34. Case histories of important IDM programmes.

Practical schedule

1. Diagnosis and detection of various plant diseases
2. Methods of plant disease measurement
3. Surveillance and forecasting of diseases
4. Assessment of crop yield losses calculations based on economics of IDM
5. Classification and grouping of fungicides
6. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%), Burgundy mixture, Chaubattia paste and Cheshunt compound.
7. Calculation of fungicides quantity and methods of application of fungicides – Seed (wetand dry) soil, foliar and post-harvest dipping.
8. Special methods of application: swabbing, acid delinting, pseudostem injection, capsule application
9. Identification of biocontrol agents
10. Mass multiplication of Trichoderma
11. Mass multiplication Pseudomonas
12. Mass multiplication Bacillus
13. Identification and nature of damage of important diseases and their management
14. Crop (agro-ecosystem) dynamics of a selected diseases
15. Plan & assess preventive strategies (IDM module) and decision making
16. Crop monitoring for attack by diseases
17. Record certification

Course outcome

CO1: Knowing the history, economic importance and principles of IDM

CO2: Having in depth knowledge in detection, diagnosis, economic injury level and economic threshold level of plant diseases

CO3: Being updated with the different principles of plant disease management with ecological management of crop environment

CO4: Having expertise in plant disease survey, forecasting and development and validation ofIDM module

CO5: Acquainted with the safety issues in pesticide uses with political, social and legal implication of IDM.

CO-PO Mapping matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	-	1	1	-
CO2	3	3	-	1	1	-
CO3	3	3	-	1	1	-
CO4	3	3	-	1	1	-
CO5	3	3	-	1	1	-

References

1. Chaube, H.S. and Pundhir, V.S. 2005. Crop Diseases and their Management. Prentice HallIndia Learning Private Limited.
2. Nene,Y.L. and Thapliyal, P.N. 2018. Fungicides in Plant Disease Control. Fourth edition. Medtech Publishers.
3. Sharma, P.D. 2016. Plant Pathology. Second edition. Rastogi Publications, Meerut.

4. Singh, R.S. 2001. Plant Disease Management. Oxford and IBH Publishing Co. Pvt., Ltd.,238p.
5. Ravichandra N.G. 2018. Agrochemicals in Plant disease management. ScientificPublishers

e- resources

1. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=11417
2. https://www.ippc.int/en/core-activities/capacity-development/phytosanitary-system/pest-risk-analysis/pra-process/
3. https://www.apsnet.org/edcenter/disimpactmngmnt/casestudies/Pages/PlantDiseaseDiagnosis.aspx
4. https://www.apsnet.org/edcenter/disandpath/prokaryote/intro/Pages/Bacteria.aspx
5. https://www.apsnet.org/edcenter/disimpactmngmnt/topc/Pages/Biological Control.aspx
6. http://npic.orst.edu/health/safeuse.html

23 GPB 302 CROP IMPROVEMENT – II (Rabi Crops) (1+1)

Learning objectives

To impart knowledge about the origin, evolution and modes of reproduction for different Rabi Crops.

- To impart knowledge about the floral biology, crossing techniques, objectives of
- breeding and wild species as donors for resistant traits.
- To impart knowledge about the Biotic and Abiotic stress resistance breeding for different
- Rabi Crops.
- To impart knowledge about the Hybrid Seed Production Technologies for different Rabi
- Crops.
- To provide insight into recent advances in improvement of cereals, pulses, oil seeds
- fodder, Cash crop, Vegetables and Flowers using conventional and modern biotechnological approaches.

Theory

Unit I: Introduction to crop improvement

Introduction-definition, aim, objectives and scope of Crop Improvement - Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops- Centers of origin-Law of homologous series- types of centres of diversity- gene sanctuaries genetic erosion-main reasons of genetic erosion-extinction-introgression- gene banks-types of gene banks-distribution of crop species.

Unit II: Crop improvement for cereals and pulses

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative characters for rabi crops- Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops 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 parameters (physical, chemical, nutritional) in different rabicrops. **Cereals** – Wheat, Oat and Barley- **pulses**- Chickpea, Lentil, Field pea-

Unit III: Crop improvement for oilseeds, fodder and cash crops

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative characters for rabi crops- Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops 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 parameters (physical, chemical, nutritional) in different rabicrops**Oilseeds** – Rapeseed, Mustard and Sunflower-**fodder crops** – Berseem and Leucerne- C**ash** crop - Sugarcane .

Unit IV: Crop improvement for vegetables and flowers crops

Centres of origin, distribution of species, wild relatives –Study of genetics of qualitative and quantitative

characters for rabi crops- Important concepts of breeding self pollinated, cross

pollinated and vegetatively propagated crops 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 parameters (physical, chemical, nutritional) in different rabi crops. **Vegetables** –Bitter guard, Snake guard, Bottle guard, Pumpkin, Cucumber and Potato– **Flowers**- Rose, Chrysanthmum
, Marigold and Gerbera.

Unit V: Seed production and resistance breeding

Seed production technology in self pollinated, cross pollinated and vegetatively propagated rabi crops- Hybrid seed production technology in Wheat, Sunflower, Rapeseed, Mustard and Cucurbits - Ideotype concept and climate resilient crop varieties for future – Breeding for drought, salinity, water logging, high temperature and low temperature tolerant varieties in different rabi crops.

Practicals

Floral biology – Types of inflorescence, flower structure in different Rabi crops- Emasculation and hybridization techniques in Wheat, Oat and Barley Chickpea, Lentil, Field pea- Rapeseed and Mustard, Sunflower-Potato, Berseem and Sugacane -Maintenance breeding of different Rabi crops – Sunflower-Handling of germplasm and segregating generations by different methods – Pedigree, Bulk and Single Seed Descent methods -Study of field techniques for varietal seed production and hybrid seed production in Sunflower, Chickpea - Study of field techniques for varietal seed production and hybrid seed production in Rapeseed and Mustard, Potato and Sugarcane- Estimation of heterosis, inbreeding depression and heritability- Layout of field experiments-Study of quality characters, donor parents for different traits in different Rabi crops-Visit to Seed production plots -Visit to AICRP plots for different field crops

Lesson Plan

Theory Lecture Schedule

1. Introduction-definition, aim, objectives and scope of Crop Improvement - Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated rabi crops.
2. Centers of origin-Law of homologous series- types of centres of diversity-gene sanctuariesgenetic erosion-main reasons of genetic erosion-extinction-introgression-genebanks-types of gene banks-distribution of rabi crop species
3. Breeding of Wheat,
4. Breeding of Oat and Barley
5. Breeding of Chickpea,
6. Breeding of Lentil, Field pea
7. Breeding of Rapeseed and Mustard
8. Breeding of Sunflower
9. **Mid semester examination**
10. Breeding of Berseem and Leucerne
11. 11.Breeding of Sugarcane
12. Breeding of Bitter guard, Snake guard, Bottle guard, Pumpkin, Cucumber
13. 13.Breeding of Potato
14. Breeding of Rose, Chrysanthmum, Marigold and Gerbera
15. 15.Seed production technology in self pollinated, cross pollinated and vegetativelypropagated rabi crops
16. Hybrid seed production technology in Wheat, Sunflower, Rapeseed, Mustard and Cucurbits

17. Ideotype concept and climate resilient crop varieties for future – Breeding for drought, salinity, water logging, high temperature and low temperature tolerant varieties in differentrabi crops

Practical schedule

1. Floral biology – Types of inflorescence, flower structure in different Rabi crops Wheat,Oat, Barley, Chickpea, Lentil, Field bean, Rapeseed, Mustard, Sunflower, Berseem, Leucerne and Sugarcane
2. Floral biology – Types of inflorescence, flower structure in different Rabi crops- Cucurbits,Potato, Rose, Chrysanthmum, Marigold, and Gerbera.
3. Emasculation and hybridization techniques in Wheat, Oat and Barley
4. Emasculation and hybridization techniques in Chickpea, Lentil, Field pea
5. Emasculation and hybridization techniques in Rapeseed and Mustard, Sunflower
6. Emasculation and hybridization techniques in Potato, Berseem and Sugacane
7. Emasculation and hybridization techniques in Cucurbits
8. Maintenance breeding of different Rabi crops – Sunflower
9. Handling of germplasm and segregating generations by different methods – Pedigree,Bulk and Single Seed Descent methods
10. Study of field techniques for varietal seed production and hybrid seed production in Sunflower, Chickpea
11. 11.Study of field techniques for varietal seed production and hybrid seed production in Rapeseed and Mustard, Potato and Sugarcane
12. Estimation of heterosis, inbreeding depression and heritability
13. Layout of field experiments
14. Study of quality characters, donor parents for different traits in different Rabi crops
15. Visit to Seed production plots
16. Visit to AICRP plots for different field crops
17. Final **practical examination**

Course outcome

CO1 : Acquire knowledge on floral biology and selection of proper breeding method for majorRabi Crops

CO 2 : Cultivate skill in emasculation and pollination methods for major Rabi Crops

CO 3 : Gain expertise on hybrid seed production techniques for major Rabi Crops

CO 4 : Learn to use different selection procedures for selection of superior genotypes for majorRabi Crops.

CO 5: To get an overview about the breeding aspects about Rabi Crops

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	**1**				
CO 2			**3**		
CO 3					**2**
CO 4					
CO 5					

References

1. Kalloo, G. 1994. Vegetable Breeding. Panima Educational Book Agency, New Delhi.
2. Kumar, N. 2006. Breeding of Horticultural Crops – Principles and Practices. New India
3. Publishing Agency, New Delhi.
4. Phundan Singh, 2006. Essentials of Plant Breeding. . Kalyani Publishers, New Delhi.
5. Poehlman, J.M. and Borthakur, D. 1995. Breeding Asian Field Crops. Oxford and IBH
6. Publishing Co., New Delhi.

7. Singh, B.D. 2006. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.

e - resources

1. https://ecourses.icar.gov.in/e-Leaarningdownload3_new.aspx?Degree_Id=01
2. http://eagri.org/
3. https://drive.google.com/file/d/1WbCKH2_ath9YkbpuYx8-bL9vbmWzljWc/view
4. https://bscagristudy.online/wp-content/uploads/2021/04/GPB-366-PRINTED-LONG-NOTE.pdf
5. https://www.rvskvv.net/images/II-Year-II-Sem_Principles_Plant-Breeding_YNAU_20.04.2020.pdf

23 HOR 302 POST-HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS ANDVEGETABLES (1+1)

Learning objectives

- To make the students learn the basics and principles of postharvest technology.
- To impart knowledge recent innovations in packaging of various horticultural crops.To make them familiarize with the storage and value addition of horticultural crops
- To make the students acquire knowledge on various postharvest management technologies on fruits and vegetables such as Jam, Jelly Candy, Squash and Picklepreparations.
- To familiarize the students to gain knowledge on conventional and modern packaging methods.

Theory

Unit I: Importance of post-harvest processing of fruits and vegetables, extent and possiblecauses of postharvest losses.

Unit II: Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening.

Unit III: Respiration and factors affecting respiration rate. Harvesting and field handling .Storage (ZECC, cold storage, CA, MA, and hypobaric).

Unit IV: Value addition concept, Principles and methods of preservation; Intermediate moisture food-Jam, jelly, marmalade, preserve, candy – Concepts and Standards, Fermentedand non-fermented beverages.

Unit V: Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning – Concepts and Standards, packaging of products and current stream of thoughts.

Practicals

Applications of different types of packaging, containers for shelf life extension. Effect oftemperature on shelf life and quality of produce. Demonstration of chilling and freezing injuryin vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.

Lesson plan

Theory Schedule

1. Importance of post-harvest processing of fruits and Vegetables, extent and possiblecauses of postharvest losses.
2. Pre-harvest factors affecting postharvest quality, maturity, ripening Changes occurringduring ripening.
3. Respiration and factors affecting respiration rate.
4. Harvesting and field handling.

5. Storage -(ZECC-Zero energy cool chamber).
6. Principles of cold storage.
7. Controlled atmosphere storage, Modified atmosphere storage, and hypobaric.
8. Value addition concept.
9. Midsemester Examinations
10. Principles and methods of preservation.
11. Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards.
12. Fermented and non-fermented beverages.
13. Tomato products- Concepts and Standards.
14. Drying/ Dehydration of fruits and vegetables – Concept and methods,
15. Osmotic drying.
16. Canning - Concepts and Standards.
17. Packaging of products.

Practical Schedule

1. Applications of different types of packaging, containers for shelf-life extension.
2. Effect of temperature on shelf life and quality of produce.
3. Demonstration of chilling and freezing injury in vegetables and fruits.
4. Extraction and preservation of pulps and juices.
5. Preparation of jam.
6. Preparation of jelly
7. Preparation of RTS.
8. Preparation of nectar.
9. Preparation of squash & crush.
10. Preparation of osmotically dried products.
11. Preparation of fruit bar and candy and tomato products.
12. Preparation of canned products.
13. Preparation of pickles.
14. Preparation of Sauces.
15. Quality evaluation of products -- physico-chemical and sensory.
16. Visit to processing industry.
17. Practical Examination

Course Outcome:

CO 1: The students will learn the basics and principles of postharvest technology.
CO 2: The students will learn the recent innovations in packaging of various horticulturalcrops.
CO3: The students will get familiarised with the storage and value addition of horticulturalcrops
CO4: The students will acquire knowledge and Prepare various postharvest management technologies on fruits and vegetables such as Jam, Jelly Candy, Squash and Pickle preparations.
CO5: The students will gain knowledge on conventional and modern packaging methods.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	3	1	3	2	0
CO 2	3	3	2	2	3	0
CO 3	3	3	1	3	3	0
CO 4	3	3	2	3	2	0
CO 5	3	3	3	2	3	0

References

1. Vennila, P. and S.Kanchana. 2003. Principles and preservation of fruits and vegetables.Ratna Publications, Madurai.
2. Jodhpur Pandey, P.H.2002. Post-Harvest Technologies of fruits and vegetablesPrinciplesand practices. Saroj Publishers and Distributors, Allahabad.
3. Sudheer, K.P. and V. Indira. 2007. Post-Harvest Technology of Horticultural Crops. NewDelhi Publishing Agency, India.
4. Thompson, A. K. 1996. Post-harvest Technology of fruits and vegetables. Blackwell science, Inc. Cambridge.
5. Verma, L.R and V.K. Joshi 2000. Post-harvest technology of fruits and vegetables (Vol Iand II). Indus publishing company, New Delhi.

e–resources

1. http://www.fao.org/DOCKEP/005 Y4358E/Y4358e04.htm
2. http://home.att.net/~africantech/GhIE/QPLFood.htm

23 EXT 302 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION(1+1)

Learning objectives

- To familiarize the students to understand with key concepts and processes inentrepreneurship and business development.
- To introduce key debates around entrepreneurship and small businesses.
- To provide context to the processes in the form differences between small and large firmsand economic environment.
- To understand the function and types of entrepreneurship.
- To develop various managerial skills among the students.

Theory

Unit I: Entrepreneurship

Concept of Entrepreneur, Entrepreneurship, Agri- Entrepreneurship, concept, need, scope and opportunities of Rural and Agri Enterprises, Entrepreneurial Characteristics, Impactof economic reforms in agribusiness and agri enterprise and over view of Agri Business in the Country.

Unit II: Entrepreneurship Development Programmes

Entrepreneurship Development Programmes (EDPs)-objectives, phases, Government policies and programmes and schemes EDP Process-Stages, Developing organizational skills (controlling, supervision, monitoring and evaluation) Achievement Motivation, Problem solving skills

Unit III: Enterprise Management

Managing an enterprise, SWOT analysis, Time Management. for Entrepreneurship Development, Financing an Enterprise and Venture Capital Institutional Support to entrepreneurs.

Unit IV: Business communication

Business written communication skills and Negotiation Skills, Managerial skills (planning, budgeting, coordination, decision making), Business Leadership skills (communication, direction and motivation skills),

Unit V: Project Management

Project- meaning, importance, project formulation, project report components and management. Supply Chain Management- Meaning, definition, process, advantages and disadvantages, Total quality Management: Meaning, definition, process, advantages and current stream of thoughts.

Practicals

Practical exercise - problem solving skills, managerial skills, decision making, creativity and time management, Identification and selection of business ideas, Planning Preparation of business plan,proposal writing and presentation. Monitoring and supervision ofentrepreneurial activities, SWOT analysis of selected enterprise. Analysis of leadership and organizational skills. Study about Entrepreneurship development Institute, Business Communication and Negotiation Study about Successful Enterprise and characteristics of Successful Entrepreneurs

Lecture Plan

Theory schedule

1. Concept of Entrepreneur, Entrepreneurship, Agri- Entrepreneurship, concept, need,scope and opportunities of Rural and Agri Enterprises
2. Entrepreneurial Characteristics
3. Impact of economic reforms in agribusiness and agri enterprise and over view of Agri Business in the Country.
4. Entrepreneurship Development Programmes (EDPs)-objectives, phases, Government policies and programmes and schemes
5. EDP Process-Stages
6. Developing organizational skills (controlling, supervision, monitoring andevaluation)
7. Achievement Motivation, Problem solving skills
8. Managing an enterprise, SWOT analysis, Time Management.
9. Mid Semester Examination
10. Business written communication skills and Negotiation Skills
11. Managerial skills (planning, budgeting, coordination, decision making) for Entrepreneurship Development
12. Financing an Enterprise and Venture Capital
13. Institutional Support to entrepreneurs
14. Business Leadership Skills (communication, direction and motivation skills)
15. Project- meaning, importance, project formulation, project report components and management.
16. Supply Chain Management- Meaning, definition, process, advantages and disadvantages
17. Total quality Management: Meaning, definition, process and advantages and currentstream of thoughts.

Practical Schedule

1. Simulation exercise on assessing entrepreneurial traits
2. Practical exercise on problem solving skills
3. Practical exercise on managerial skills
4. Identification and selection of business ideas
5. Practical exercise on decision making
6. Planning, Preparation of business plan and proposal writing.
7. Monitoring and supervision of entrepreneurial activities
8. Practical exercise on Creativity
9. Presentation of business proposal
10. Practical exercises on time Management / time Audit
11. SWOT analysis of selected enterprise.
12. Analysis of Leadership Skills and organization skills
13. Visit to Entrepreneurship Development Institute
14. Business Communication and Negotiation
15. Field Visit to Successful Enterprise

16. Case Study of Successful Entrepreneurs
17. **Practical Examination**

Course Outcome

At the end of the course students will be able to

CO 1: Develop entrepreneurial competencies among the students
CO 2: Learn about principles to develop an enterprise or any business unit
CO 3: Gain expertise on SWOT analysis
CO 4: Exposure on entrepreneurial traits and culture
CO 5: To gain knowledge about enterprise and project management

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	2	0	3	3
CO2	1	0	0	2	0	3
CO3	2	2	0	0	3	3
CO4	2	0	1	0	0	3
CO 5	1	0	0	0	0	3

References

1. Anil Kumar S, Poornima S C, Mini K Abraham and Jayashree K 2003 Entrepreneurship development, New Age International Publishers, New Delhi-110002
2. Sagar Mondal 2020, Entrepreneurship Development and Business Communication, Kalyani Publisher, New Delhi.
3. Indu Grover 2008 Handbook on Empowerment & Entrepreneurship, Agrotech PublicAcademy
4. Mohanty S K, 2009, Fundamentals of Entrepreneurship, Prentice Hall of India, New Delhi
5. Sagar Mondal & G L Ray 2009 Text book of Entrepreneurship, Rural development and Communication skills.

e-resources

1. https://ddceutkal.ac.in
2. https://ecourseonline.iasri.res.in
3. https://www.agrimoon.com
4. https://courseware.cutm.ac.in
5. https://www.dvermapdf.in

23 AEC- 303Agricultural Finance and Co-operation (1+1)

OBJECTIVES

- To inculcate the knowledge on principles of finance and banking
- To understand the micro financial institutions
- To study the functions of various institutions involved farm financial analysis
- To provide the knowledge on co-operative credit structure
- To know the benefits of insurance schemes and different crop insurance products implemented in India.

Theory

Unit I: Agricultural Finance – Nature and Scope:

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Sources of credit -

advantages and disadvantages - Rural indebtedness- History and Development of rural credit in India.

Unit II: Financial Institutions:

Sources of agricultural finance: institutional and non-institutional sources and their roles, commercial banks - social control and nationalization of commercial banks – AD branches – Area approach – Priority sector lending. Micro financing including KCC, Micro finance – SHG Models, Lead Bank Scheme, RRBs, Scale of finance and unit cost. Cost of credit. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Recent development in agricultural credit: Rural credit policies of Government – Subsidized farm credit - Differential Interest Rate (DIR) Scheme – Loan relief measures

Unit III: Farm Financial Analysis:

Credit analysis: 3 R's,7 P's and 5 C's of credit. Preparation of bankable projects / Farm credit proposals – Feasibility; Appraisal - Time value of money: Compounding and Discounting - Undiscounted and Discounted measures. Preparation and analysis of financial statements Balance Sheet, Income Statement and Cash Flow Statement. Basic guidelines for preparation of project reports - Bank norms – SWOT analysis.

Unit IV: Co-operation:

Agricultural Cooperation in India–Meaning, brief history of cooperative development in India - Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Cooperative credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED. Strength and weakness of co-operative credit system, Policies for revitalizing cooperative credit.

Unit V: Banking and Insurance:

Negotiable Instruments: Meaning, Importance and Types - Central bank: RBI – functions- Credit control – Objectives and Methods: CRR, SLR and Repo rate - Credit rationing - Dearmoney and cheap money. monetary policies. Credit gap: Factors influencing credit gap. Non -Banking Financial Institutions (NBFI). NPA – Causes, consequences and mitigation. Crop Insurance: Schemes, Coverage, Advantages and Limitations in Implementation. Weather based crop insurance, features, determinants of compensation. Livestock Insurance Schemes - Agricultural Insurance Company of India Ltd (AIC): Objectivesand functions.

Practicals

Determination of most profitable level of capital use. 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 / cooperative society to acquire first- hand knowledge of their management, schemes and procedures. Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures for availing loan – Fixation of Scale of Finance. Estimation of credit requirement of farm business – A case study. Preparation and analysis of Balance Sheet, and Cash Flow Statement – A case study. Exercise on Financial Ratio Analysis. Appraisal of farm credit proposals – A case study. Preparation and

analysis of income statement – A case study. Preparation of Bankable projects / Farm Credit Proposals and appraisal - Undiscounted methods and Discounted methods. Technoeconomic parameters for preparation of projects for various agricultural products and its value added products. Seminar on selected topics. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.

Lesson plan

Theory Schedule

1. Agricultural Finance - meaning, scope and significance, credit needs and its role in Indian agriculture. Rural indebtedness - History and Development of rural credit in India.

2.Agricultural credit: meaning, definition, need and classification. Sources of credit - advantages and disadvantages. Sources of agricultural finance: institutional and non- institutional sources - their roles. Commercial banks - social control and nationalization of commercial banks.

3. Micro financing including KCC, Micro finance – SHG Models, Lead bank scheme.8. RRBs, Scale of finance and unit cost. Cost of credit.

4. An introduction to higher financing institutions–RBI, NABARD, ADB, IMF and World Bank. Role of Insurance and Credit Guarantee Corporation of India.

5. Recent developments in agricultural credit. Rural credit policies of Government: Subsidized farm credit- Differential Interest Rate (DIR)Scheme– Loan relief measures

6. Credit analysis: 3 R's, 7 P's and 3C's of credit.

7. Preparation of bankable projects / Farm credit proposals – Feasibility. Appraisal: Time value of money: Compounding and Discounting - Undiscounted and Discounted measures.

8. Preparation and analysis of financial statements – Balance Sheet, Income Statement and CashFlow Statement.

9. Mid Semester Examination

10. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

11. Agricultural Cooperation in India – Meaning, brief history of cooperative development in India. Pre and Post - Independence periods and Co-operation in different plan periods, objectives, principles of cooperation, significance of cooperatives in Indian agriculture.

12. Co-operating credit structure: short term and long term. Agricultural Cooperation - credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies,processing cooperatives, farming cooperatives, cooperative warehousing;

13. Role of ICA, NCUI, NCDC and NAFED. Strength and weakness of co-operative creditsystem, Policies for revitalizing co-operative credit.

14. Negotiable Instruments: Meaning, Importance and Types. Credit gap: Factors influencingcredit gap.

15. Central bank: RBI – functions, Credit control – Objectives and Methods: CRR, SLR and Repo rate. Credit rationing - Dear money and cheap money.

16. Financial Inclusion and Exclusion: credit widening and credit deepening monetary policies. Non - Banking Financial Institutions (NBFI). NPA – Causes, consequences and mitigation.

17. Crop Insurance and Livestock Insurance Schemes: Coverage, Advantages and Limitations in Implementation. Weather based crop insurance, features, determinants of compensation. Agricultural Insurance Company of India Ltd (AIC): Objectives and functions.

Practical Schedule

1. Determination of most profitable level of capital use.
2. Optimum allocation of limited amount of capital among different enterprises.

3. Analysis of progress and performance of cooperatives using published data.
4. Analysis of progress and performance of commercial banks and RRBs using published data.
5. Visit to a commercial bank, cooperative bank / cooperative society to acquire first - hand knowledge of their management, schemes and procedures.
6. Visit to District Central Co-operative Bank (DCCB) to study its role, functions and procedures
for availing loan – Fixation of Scale of Finance.
7. Guest lecture on Role and functions of Commercial Bank and Lead Bank / NABARD and itsRole and Functions.
8. Estimation of credit requirement of farm business – A case study.
9. Preparation and analysis of Balance Sheet and Cash Flow Statement – A case study.
10. Exercise on Financial Ratio Analysis. Appraisal of farm credit proposals – A case study.
11. Preparation and analysis of income statement – A case study.
12. Preparation of Bankable projects / Farm Credit Proposals and appraisal.
13. Undiscounted methods and Discounted methods.
14. Techno-economic parameters for preparation of projects for various agricultural products and its value added products.
15. Analysis of Different Crop Insurance Products / Visit to crop insurance implementing agency.
16. Seminar on selected topics.
17. Practical Examination.

Course Outcomes

CO1: To understand the functions of various institutions involved in farm financing.
CO2: To know the principles of credit,5c's,3R'sand time value of money.
CO3: To gain knowledge on microfinance, role of SHG's, NGO.
CO4:To understand risk mitigating measures like agricultural insurance schemes available for the benefits of famers.
CO5: To know the different crop insurance schemes in India

CO-POMapping Matrix

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	-	-	-	-	2
CO2	3	-	-	-	-	-
CO3	2	-	-	-	-	-
CO4	2	-	-	-	-	2
CO5	2	-	-	1	2	-

References

1. Muniraj,R.1987.FarmFinancefor Development, Oxford and IBH, New Delhi.
2. SubbaReddy, S and P. Raghu Ram, 2011.Agricultural Finance and Management, Oxford andIBH, New Delhi.
3. Lee,W.F., M.D. Boehlje, A.G. Nelson and W.G. Murray, 1998. Agricultural Finance, Kalyani Publishers, New Delhi.
4. Mammoria,C.B.andR.D.Saxen,1973.CooperationinIndia, Kitab Mahal, Allahabad.
5. Patnaik,V.E.andA.K.Roy.1988.CooperationandCooperativeManagement, Kalyani Publishers, Ludhiana.

e-resources

1. https://www.iaritoppers.com/2019/06/angrau-notes-download-angrau-study-material.html
2.https://www.academia.edu/31604110/LECTURE_NOTES_Course_No_AECO_142_Agricultural_Finance_and_Co_operation
3. http://hillagric.ac.in/edu/coa/agriecoextedursocio/Study%20Materials/AgEcon233.pdf
4. https://agrimoon.com/wp-content/uploads/Agricultural-Finance-Cooperation.pdf
5. https://www.agristudyinfo.com/agricultural-finance-cooperation-notes-pdf-download/

23 STA 301 STATISTICAL METHODS (1+1)

Learning objectives

- To understand and apply fundamental concept of statistical applications in biology
- To acquire about theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

Theory

Unit I: Diagrams and graphs

Introduction to Statistics, Definition, Advantages & Limitations, Quantitative and Qualitative data- Discrete and Continuous Variables. Diagrammatic representations Bar Graphs- PieGraphs - Graphical Representation – Frequency histogram, Frequency polygon, frequency curve and ogives.

Unit II: Measures of Central Tendency and Dispersion

Measures of Central Tendency: Definition, Different Measures, Characteristics of a Satisfactory Average. Definition and Calculation of Arithmetic Mean, Median and Mode -Merits and Demerits. Measures of Dispersion: Standard Deviation, Variance and Coefficient ofVariation

Unit III: Probability Distribution and Bivariate Analysis

Introduction to Probability—Events, Sample Space, Definition of Probability, Addition andMultiplication Theorem (without proof). Binomial Distribution, Poisson Distribution. NormalDistribution (Concepts only)

Introduction to Correlation: Definition, Scatter Diagram, Types of correlation, Properties - Karl Pearson's correlation coefficient. Regression – definition – fitting of two simple linear regression equation – properties of regression coefficient. Chi-square test

Unit IV: Tests of Significance

Definitions of Statistical Population, Sample, Random Sampling, Parameter, Statistic. Sampling distribution, Standard error - Test of Significance, Null Hypotheses, Types of Errors, Level of Significance and Degrees of freedom, Steps involved in Testing of a Hypotheses. Large sample tests: Test of single and difference of proportions - Test of single and difference of means.

Small sample tests: students t test for one and two samples. Paired T test and test for correlation coefficient. Chi-square test for attributes, F test for equality of variances.

Unit V: Design of Experiments

Analysis of Variance (ANOVA) – assumptions – one way and two way classifications. Basic principles of experimental designs – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD). **Current Streams of thought.**

Lesson plan

Theory Schedule

1. Introduction to Statistics, Definition, Advantages & Limitations, Applications in Agriculture, Data - Types of data – Quantitative and Qualitative Variables- Discrete and Continuous Variables
2. Simple bar diagram, Multiple Bar, percentage bar and Pie diagram—Histograms, Frequency polygon, frequency curve
3. Definition, Different Measures, Characteristics of a Satisfactory Average. Definition and Calculation of Arithmetic Mean, Median and Mode for Ungrouped data
4. Arithmetic Mean, Median and Mode for Grouped data. Merits and Demerits of AM, Median and Mode
5. Standard Deviation, Variance and Coefficient of Variation
6. Introduction to Probability—Events, Sample Space, Definition of Probability, Addition and Multiplication Theorem (without proof)
7. Binomial Distribution, Poisson Distribution. Normal Distribution
8. Correlation: Definition, Scatter Diagram, Types of correlation, Karl Pearson's correlation coefficient
9. **Mid Semester Examination**
10. Regression: Definition, Fitting of two lines Y on X and X on Y, Properties, inter relation between correlation and regression
11. Definitions of Population, Sample, Random Sampling, Parameter, Statistic. Sampling distribution, Standard Error, Null Hypotheses, alternate Hypotheses, Types of Errors, Levelof Significance and Degrees of freedom, Steps involved in Testing of a Hypotheses
12. Large sample tests - Test of single and difference of proportions - Test of single and difference of means, Null Hypotheses, Test Statistic Table values and Inference (Conclusion about Null Hypotheses)
13. Small sample tests: students t test for one and two samples. Paired T test and test for correlation coefficient
14. Chi-square test in 2x2 and r x c Contingency table. F-test for Two Population variancesand properties Assumptions
15. Analysis of Variance (ANOVA) – assumptions – one way and two way classifications.
16. Basic principles of experimental designs - Completely Randomized Design (CRD) –
17. Randomized Block Design (RBD) - Latin Square Design (LSD)

Practical schedule

1. Simple bar diagram. Multiple bar diagram, percentage bar diagram and pie diagram
2. Frequency histogram, Frequency polygon, frequency curve and ogives
3. Calculation of Arithmetic Mean, Median and Mode for ungrouped data
4. Calculation of Arithmetic Mean, Median and Mode for grouped data
5. Computation of Standard Deviation, Variance and Coefficient of Variation for ungroupeddata
6. Computation of Standard Deviation, Variance and Coefficient of Variation for grouped data
7. Computation of Karl Pearson's correlation coefficient
8. Computation of regression equations
9. Solving problems for long sample test for single proportion and difference of proportions
10. Large sample test – test for single mean and difference between two means
11. Small samples test – one sample t-test, two sample t test and paired t test
12. Chi-square test for 2x2 contingency table and r xc contingency table
13. F test for two population variances
14. Analysis of Completely Randomised Design (CRD)
15. Analysis of Randomised Block Design (RBD)
16. Analysis of Latin Square Design (LSD)
17. **Practical Examination**

Course Outcome

CO1: Understand fundamental concept of statistical applications in biology

CO2: Application of statistical concepts

CO3: Acquire theoretical concept of descriptive statistics, testing of hypothesis, correlation, regression and basic design of experiments.

CO4: Practical exposure to concept of descriptive statistics, testing of hypothesis, correlationand regression

CO5: Practical exposure to basic design of experiments

CO - PO Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	-	-	X	X
CO2	-	-	-	-	X	X
CO3	-	-	-	-	X	X
CO4	-	-	-	-	X	X
CO5	-	-	-	-	X	X

References

1. Rangaswamy, R. 2009, A Text book of Agricultural Statistics, Wiley Eastern Limited, NewDelhi.
2. Statistics for Agricultural Sciences-Second Edition,2007 - G. Nageswara Rao, BSPublications, Hyderabad.
3. Dhamu. K. P and K. Ramamoorthy. 2007. Statistical Methods. Agrobios (India), Jodhpur.
4. Hand Book of Agricultural Statistics, Chandel SRS, Achal Prakashan Mandir publications, New Delhi.
5. Gupta S.P, Statistical Methods, 2004, Sultan Chand and Sons, New Delhi.

e-resources

1. http://www.statistics.com/resources/glo.ssary/
2. www.statsoft.com
3. http://www.iasri.res.in/ebook/EB_SMAR/index.htm
4. www.stats.gla.ac.uk/steps/glossary/index.html
5. http://davidmlane.com/hyperstat/

23 AEG 301 FARM MACHINERY, POWER AND RENEWABLE ENERGY SOURCES (1+1)

Learning objectives

- To impart knowledge to the students on the significance, use and maintenance of farmpower and improved farm equipment through various media including demonstrations.
- To gain knowledge on the various types of IC engines, types and selection of tractors.
- To understand the construction and working of various farm implements like tillageimplements, seed drills, plant protection and harvesting equipments.
- To gain knowledge on the various renewable energy sources like solar, wind, biogas andbiomass energy.
- To understand the construction and working of various solar energy gadgets, windmill, biogas plants and production of bio diesel and ethanol from agricultural produce.

Theory

Unit I: Farm power sources, Mechanical Machinery and Tractors

Status of farm power in India-farm mechanization for enhancing productivity - sources of farm power – advantages and disadvantages-IC engines- Working principles, Two stroke and four stroke engines, IC engine terminology, modern agriculture diesel engine, Electronic fuel injection, dual fuel operation engine , Tractors- Types and Utilities.

Unit II: Tillage and Tillage Machinery, Sowing, Planting, Intercultural Equipment

Farm sources-Tillage – Ploughing Methods - Primary Tillage-Implements –Types of plough – Secondary

tillage implements –Cultivators, Harrows and rotavators – Wetland equipment - Puddlers, Tramplers and Cage Wheel. Sowing Methods - Seed Drills, Seed cum fertilizer drills
- Paddy transplanters.

Unit III: Plant Protection Gadgets, Harvesting Machinery and Equipment for Land Development

Plant protection, Harvesting equipment - Combine harvesting machinery for groundnut, Tuber crops and Sugarcane - Tools for horticultural crops, Equipment for land development – Cost of

operation of farm machinery, Implements for intercultural operations, Tools for horticulturalcrops.

Unit IV: Energy scenario and biomass energy conversion systems

Introduction – Energy crisis – Classification – Availability –Renewable energy sources – significance – Potential of Solar, Wind, Biogas, Biomass, and other Renewable Energy sourcesachievements in India- Methods of energy conversion - Thermo chemical conversion methods
-Principles of combustion, Pyrolysis and gasification – Types of gasifiers –Producer gas andits utilization. Briquettes – Types of briquetting machines – Uses of briquettes – Shredders- biochemical conversion methods - Biogas and Ethanol Production – Applications. -Biogas technology – Feed stocks – Factor influences biogas yield–Biogas Plants Types – Construction and Working - Applications.

Unit V: Solar energy, Wind energy and bio – fuels and its applications

Solar energy– Solar energy applications – Solar collectors-Types – Solar energy gadgets –Solar air heaters – Solar cookers – Solar water heating systems –Solar grain dryers – Solar photo voltaic systems and application–Solar lights –Solar pumping systems – Solar refrigeration system – Solar ponds – Solar space heating and cooling systems. Wind energy
–Types of wind mills – Constructional details and applications. Energy from agricultural wastes
– Liquid Bio fuels – Bio diesel and ethanol from agricultural produce – Its production and Uses.

Lesson plan

Theory Schedule

1. Status of farm power in India - farm mechanization for enhancing productivity - sources offarm power – advantages and disadvantages.
2. Internal combustion (IC) engines – working principle – four stroke and two stroke cycle engines – difference between the two types- components of IC engine -Working principle of IC engines using diesel and petrol as fuels.
3. Familiarization with various systems of tractor – Power Transmission from engine to rear wheels – role of different units in speed reduction and transmission of power.
4. Tractors – classification – factors to be considered while purchasing a tractor. Costanalysis of owning and operating tractor and implements
5. Tillage – primary and secondary tillage- mould board plough- constructional features - components of MB plough and their functions – limitations of MB plough - Standard disc plough– constructional features and operational adjustments - determination of theoreticaland effective field capacities, field efficiency- numerical problems on drawbar power and field capacity in Metric and SI units.
6. Secondary tillage implements – harrows – different types – classification of disc harrows, cultivators – rigid tine and spring tine types- Methods of sowing-sowing implements-seed drills and planters-seed metering mechanism – calibration of seed drill and numerical problems on the subject.
7. Tractor - mounted equipment for land management – bund former, ridger and terraces blade - Equipment for manual and power harvesting- sickle and harvester combines - methods of harvesting fruits crops in hill areas.
8. Introduction – renewable energy sources – classification – advantages and disadvantages
9. **Mid Semester Examination**
10. Biomass – importance of biomass – classification of energy production – principles of combustion – pyrolysis and gasification - Biogas – principles of biogas production – advantages and

disadvantages – utilization

11. Biogas plants – classification – types of biogas plants – constructional details of biogas plants -Types of gasifiers – producer gas and its utilization - Briquettes – briquetting machinery – types and uses of briquettes – shredders
12. Solar energy – application of solar energy – methods of heat transfer – conduction, convection and radiation
13. Solar appliances – flat plate collectors – focusing plate collectors – solar air heater – solarcookers – solar water heating systems - Solar grain dryers – solar refrigeration system – solar ponds
14. Solar photovoltaic system – solar lantern – solar streetlights – solar fencing – solar water pumping system
15. Wind energy – constructional details of windmills – applications of windmills advantages – disadvantages – wind mills – types
16. Bio fuels – characteristics of various bio fuels – different parameters and calorific values- Bio diesel production – applications – extraction from *Jatropha*
17. Ethanol from agricultural produce (sugar cane and corn)

Practical schedule

1. Study of various components of IC engine and Study of two stroke and four stroke cycleengines.
2. Familiarization with air cleaning and fuel supply system
3. Familiarization with lubrication system and ignition system of tractor
4. Learning tractor driving
5. Familiarization with primary tillage implements – MB plough and disc plough – to studyMB plough and disc plough in operation.
6. Familiarization with secondary tillage implements study of harrows and cultivators
7. Familiarization with sowing implements - study of seed-cum-fertilizer drill- calibration ofseed drill.
8. Familiarization with various sprayers and dusters.
9. Familiarization with harvesting implements – study of mower.
10. Constructional details of different types biogas plants and gasifiers
11. To study the briquettes preparation from biomass
12. To study the performance of a solar still solar dryers and domestic solar water heater
13. To study the working of solar photovoltaic pumping system
14. To study the performance evaluation of solar lantern and solar street light
15. To study the performance of different types of wind mills
16. To study the processing of bio diesel production from Jatropha
17. **Practical Examination**

References

1. Ojha, T.P and A.M. Michael 2005. Principles of Agricultural Engineering Vol-I. Jain Brothers, New Delhi. ISBN: 978-8186321638
2. Nakra C.P 1970. Farm Machinery and Equipment: Dhanpat Rai Publishing Company Ltd,New Delhi ISBN: 978-8187433231
3. Srivastava, A.C., 1991. Elements of Farm Machinery. Oxford and IBH Publishing Co PvtLtd, New Delhi. ISBN: 978-8120405134
4. Senthilkumar, T., R. Kavitha and V. M. Duraisamy. 2015. A Text Book of Farm Machinery, Thannambikkai Publications, Coimbatore. ISBN: 978-9381102305
5. Renewable Energy, Godfrey Boyle (Editor) ISBN: 0199261784 / ISBN-13:

e-resources

1. www.agricoop.nic.in/dacdivision/Machinery1/directory.htm

2. www.farmmachineryshow.org
3. www.freesolaronline.com

23 ECAGR 305 SYSTEM SIMULATION AND AGRO-ADVISORY (AGR) (2+1)

LEARNING OBJECTIVES

- To acquire knowledge on the basic aspects of crop models
- To impart knowledge on the crop growth model and response to weather ailments
- To be familiar with soil water and nutrient balance
- To studying about weather forecasting
- To know about crop weather calendar

THEORY:

Unit I: System and Models

System Approach for representing soil-plant-atmospheric continuum, system boundaries. Crop models - concepts and techniques, types of crop models, data requirements, relational diagrams.

Unit II: Validation of models

Evaluation of crop responses to weather elements - Elementary crop growthmodels-calibration, validation, verification and sensitivity analysis.

Unit III: Modelling techniques

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.

Unit IV: Weather forecasting and verification

Weather forecasting- types, methods, tools and techniques, forecast verification;Value added weather forecast. ITK for weather forecast and its validity

Unit V: Simulation and Agromet Advisory Bulletins

Crop-Weather Calendars- Preparation of agro-advisory bulletin based on weatherforecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination and current stream of thoughts.

PRACTICAL:

Preparation of crop weather calendars. Preparation of agro-advisories based onweather forecast using various approaches and synoptic charts. Working with statisticaland simulation models for crop growth. Potential and achievable production; yieldforecasting, insect and disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop

management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agro advisory.

Theory

Lesson Plan

1. System-definition-scope

2. Models- definition - scope.
3. Soil-plant-atmospheric continuum
4. Model- System boundaries – inputs
5. Models limitations- constrains
6. Crop models, concepts and techniques
7. Types of crop models – Abstract models
8. Types of crop models – Simulation Models.
9. Input and output data requirements, relational diagrams.
10. Evaluation of crop responses to weather elements;
11. Elementary crop growth models
12. Calibration, validation, verification
13. Sensitivity analysis of models.
14. Potential and achievable crop production
15. Concept and modelling techniques for estimation of yields
16. Crop production in moisture and nutrients limited conditions;
17. Components of soil water and nutrients balance.
18. Mid semester exam
19. Weather forecasting- definitions- scope
20. Types of weather forecasting
21. Methods of weather forecasting and tools
22. Techniques of weather forecasting and forecast verification
23. Value added weather forecast.
24. Now casting and its application.
25. National Centre for Medium Range Weather Forecasting (NCMRWF) and Agro Meteorological Field Units (AMFU) and forecasting.
26. Gramin Krishi Mausam Sewa (GKMS) and District Agromet field Units (DAMU) - role in weather forecasting.
27. Long Range Weather Forecasting (LRF)
28. ITK for weather forecast and its validity
29. Preparation of agro-advisory bulletin based on weather forecast.
30. Use of crop simulation model for preparation of Agro-advisory
31. Dissemination of weather forecasting and its mode.
32. Crop-Weather Calendars
33. IMD and its role in weather forecasting.
34. Websites and information on weather forecasting and current stream of thoughts.

Practical Schedule

1. Visit to Agro meteorological Observatory.
2. Preparation of crop weather calendars.
3. Preparation of agro-advisories based on weather forecast using various approaches
4. Synoptic charts
5. Working with statistical and simulation models for crop growth
6. Potential and achievable production, yield forecasting
7. Insect and disease forecasting models.
8. Simulation with limitations of water and nutrient management options.
9. Sensitivity analysis of varying weather and crop management practices.
10. Use of statistical approaches in data analysis and

11. Preparation of historical, past and present meteorological data for mediumrange weather forecast.
12. Feedback from farmers about the agro advisory.
13. Visit to GKMS centre / AIR, Karaikal
14. Visit to IMD, DWRS, Karaikal
15. Visit to RMC, Chennai
16. Field visits
17. **Practical examination**

COURSE OUTCOMES

- **CO1:** Student can learn about the basic aspects of crop models concepts and techniques.
- **CO2:** Students can understand knowledge on crop growth model and response toweather elements**.**
- **CO3:** Student learn about soil water and nutrient balance.
- **CO4:** Student can study about concept and modelling techniques for estimation ofyields.
- **CO5:** Student can study about weather forecasting and crop weather calendar**.**

CO-PO MAPPING MATRIX

	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	1	2	-	1	-	-
CO2	2	1	-	1	-	1
CO3	3	1	-	1	1	1
CO4	1	1	1	-	1	2
CO5	1	1	1	-	1	1

REFERENCES

- Gopalaswamy, N. 1994. Agricultural Meteorology, Rawat publications, Jaipur.
- Mavi, H.S., 1996. Introduction to Agro meteorology, oxford andIBH Publishing Co., New Delhi.
- Narayanan.AL.2015. Principles of Applied Agricultural Meteorology, SriVelan Pathipagam, Chidambaram.
- Rao, G.S.L.H.V. 2005. Agricultural Meteorology. Kerala Agricultural University Press, Thrissur.
- Reddy, S.R. 2014. Introduction to Agriculture and Agro meteorology. Kalyani Publishers, New Delhi.
- Patra, A.K. 2016. Principles and Applications of Agricultural Meteorology.New India Publishing Agency, New Delhi.

E-REFERENCES:

1. www.pajancoa.ac.in
2. www.tawn.tnau.ac.in
3. www.usbr.gov/pn/agri.met
4. www.imd.gov.in
5. www.agromet.imd.gov.in

23 ECEXT 303 AGRICULTURAL JOURNALISM (2+1)

Learning objectives

- To acquaint the students with the concepts of Journalism and how to write theagriculturalnews for print and electronic media for effective transfer of technology.
- To impart knowledge on Agricultural Journalism and its role in agricultural development.
- To inculcate skills in script writing for different media.
- To gain knowledge about the photo journalism
- To understand the role of social media in Farm journalism

Theory

Unit I: Introduction to Journalism

Journalism: Definition, meaning, functions & its role. Different types of Journalism with examples, Agricultural Journalism-Nature, scope, importance of Agricultural Journalism in TOT, Journalist-definition, roles, responsibilities, Characteristics, Agricultural Journalist – definition, roles, responsibilities, Characteristics of Farm Journalist, Distinguishing features of farm journalism- Different from other types of journalism

Unit II: News, Newspapers and magazines

News-Characteristics of News, Types of News, sources of News, Agricultural News, Characteristics, the types and sources of Agricultural News, Newspapers and magazines as a communication media, Characteristics, kinds and functions of newspapers and magazines, Characteristics of newspaper and magazine readers, Form, content, style and language of newspapers and magazines, Parts of newspapers and magazines

Unit III: News story and feature story

News story-Meaning, definition purpose, writing of news story, principles and parts, Agricultural story-Types- success story, feature story, news story, Feature story-Meaning, definition, purpose, writing of feature story, -principle-Parts, Writing news stories with differenttypes of leads,

Unit IV: Photo journalism, script writing for radio and TV

Photo journalism, meaning, role and its importance in transfer of technology, Use of art works, graphs, charts, maps in Agricultural Journalism, Writing attractive captions, Layout of Agricultural News, Readability, meaning, definition, concept and Measurement, Writing of radio script for delivering of radio talk, Writing of Story Board for Television and videoprogramme

Unit V: Social media and digital journalism

Role of social media in farm journalism, Editing of news story, Farm advertisement and role and its importance in Agricultural Journalism, Proof Reading, Digital Journalism- concept, definition, scope and significance, Concepts and principles, Photo journalism elements and techniques, Difference between traditional and e-journalism, E-journals and magazine in agriculture and current stream of thoughts.

Practical

Exercise on collection of Agricultural information through interview, coverage of agricultural events, Collecting information from agricultural research, writing of news stories & success stories, Selection for writing of Agricultural News story/Success Story, preparation of ArtWorks for writing of Agriculture NewsStory/Success Story, Measuring readability of the written News Story/Success Story, Writing of Radio Scripts, Planning and writing of Story Board, Visit to Print Media Office & Electronic Media office, Preparation of interview schedule to study the farmer preference towards mass media, Designing a programme on interview with farmer, Preparation of short film, Designing cover page for farm magazine

Lesson Plan

Theory Schedule

1. Journalism: Definition, meaning, functions & its role.
2. Different types of Journalism with examples
3. Agricultural Journalism-Nature, scope, importance of Agricultural Journalism in TOT

4. Journalist- definition, roles, responsibilities, Characteristics
5. Agricultural Journalist – definition, roles, responsibilities, Characteristics of FarmJournalist
6. Distinguishing features of farm journalism-Different from other types of journalism
7. News-Characteristics of News, Types of News, sources of News
8. Agricultural News, Characteristics, the types and sources of Agricultural News
9. Newspapers and magazines as a communication media
10. Characteristics, kinds and functions of newspapers and magazines
11. Characteristics of news paper and magazine readers
12. Form, content, style and language of newspapers and magazines
13. Parts of newspapers and magazines
14. News story-Meaning, definition purpose, writing of news story, principles and parts
15. Agricultural story-Types- success story, feature story, news story
16. Feature story-Meaning, definition, purpose, writing of feature story, -principle-Parts
17. **Mid Semester Examination**
18. Writing news stories with different types of leads
19. Photo journalism, meaning, role and its importance in transfer of technology
20. Use of art works, graphs, charts, maps in Agricultural Journalism
21. Writing attractive captions
22. Layout of Agricultural News
23. Readability, meaning, definition, concept and Measurement
24. Writing of radio script for delivering of radio talk
25. Writing of Story Board for Television and video programme
26. Role of social media in farm journalism
27. Editing of news story
28. Farm advertisement and role and its importance in Agricultural Journalism
29. Proof Reading
30. Digital Journalism- concept, definition, scope and significance
31. Digital Journalism - components and principles
32. Photo journalism elements and techniques
33. Difference between traditional and e-journalism
34. E-journals and magazine in agriculture and current stream of thoughts

Practical Schedule

1. Exercise on collection of Agricultural information through interview
2. Exercise on coverage of agricultural events
3. Exercise on collecting information from agricultural research
4. Exercise on writing of news stories
5. Exercise on writing of success stories
6. Selection for writing of Agricultural News story/Success Story
7. Exercise on Selection and preparation of Art Works for writing of Agriculture News Story/Success Story
8. Exercise on Editing of news story/Success story
9. Measuring readability of the written News Story/Success Story
10. Writing of Radio Scripts
11. Planning and writing of Story Board
12. Visit to Print Media/Electronic Media Office
13. Preparation of interview schedule to study the farmer preference towards mass media
14. Designing a programme on interview with farmer
15. Preparation of short film
16. Designing cover page for farm magazine

17. Final Practical Examinations

Course Outcome

CO 1: Describe the concepts of Journalism, agricultural journalism& characteristics ofagricultural news.

CO 2: Gain knowledge and skills in writing the Agricultural News stories and evaluation of them.

CO 3: Develop knowledge on print media and electronic media related toAgricultural Journalism.

CO 4: Develop skill in evaluation and measurement of readability of written News stories etc.CO 5: Develop skill in preparation of radio scripts and story boards.

Co-Po Mapping Matrix

	PO 1	PO2	PO3	PO4	PO5	PO6
CO1	1	2	2	2	3	1
CO2	-	-	1	1	-	-
CO3	1	1	-	1	2	1
CO4	-	-	2	-	-	1
CO 5	1	1	1	-	1	=

References

1. A.K. Singh. 2014. Agricultural Extension and Farm Journalism. .Agrobios, Jodhpur
2. Rabindranath.2013. Editing Principles and Practices. Motilal Banarsidass Publishers (P)Ltd.New Delhi.
3. Mehta, D. S. 1979. Mass Communication and Journalism in India. Allied Publishers Ltd.New Delhi.
4. Dileep Kumar Dangi.2012. Mass Communication in Agricultural Extension..Astral International (P) Ltd. New Delhi
5. Ahuja, B. N. 1979. Theory and practice of journalism. Surjeeth publication, Delhi

e-resources

1. https://ecoursesonline.iasri.res.in
2. https://annamalaiuniversity.ac.in
3. https://content.kopykitab.com
4. https://www.teachmint.com
5. https://pdfprof.com

23 ECAHS 301 CAPRINE AND OVINE MANAGEMENT (2+1)

Learning Objectives

- The course is designed to teach students about various sheep and goat rearingtechniques with a focus on effective breeding techniques.
- To disseminate information on scientific sheep and goat housing for optimal microclimateso as to improve the production.
- To educate about different types of grazing, feeding, and the importance of specialfeeding methods.
- To offer adequate knowledge of sheep and goat disease prevention including variousclinical signs and other prophylactic measures.
- To give a thorough understanding of goat milk production and to inculcate the importanceof goat milk.

Theory

Unit I: Introduction to Goat and Sheep Management

Introduction - Scope of Goat and Sheep farming - Common Terminologies – Breeds - Classification of

reeds based on milch, wool, meat and dual purpose in goats/sheep -Breeding management - Estrous cycle - Seasonally polyestrous animal- Types of mating - Artificial Insemination - Controlled breeding - Pregnancy diagnosis in Sheep and Goat

Unit II : Farming Practices

Sedentary farming - Nomadic farming – pastoralism – silvipasture - extensive, intensive, semi intensive - integrated farming system – Tethering - housing management - selection of site - floor space requirement of goat and sheep - systems of housing - pen, run, elevated slat system - care and management of Buck, Doe and Kids

Unit III: Nutrition

Nutrients requirements - Grazing - Scientific feeding of sheep and goat - feeds and fodders - flushing Vs steaming up

Unit IV: Disease Management

Introduction to caprine and ovine diseases - sign of health- deworming – dipping - vaccination - general control measures of diseases

Unit V: Products Technology

Caprine Milk and its importance - composition, yield and product preparation - meat- composition - Nutritive value – slaughtering methods- dressing percentage- processing and preservation- Current stream of thoughts.

Practicals

External parts of goat/sheep- Identification methods -Restraining methods -Castration and hoof trimming- Judging -Dentition -Type and design of goat house- oestrus detection- ArtificialInsemination- Recording physiological parameters – Endoparasites and Ectoparasites control-Feeds and fodders - Economic traits- farm records-Dressing Procedures.

Lesson Plan

Theory Schedule

1. Introduction to sheep/goat farming and its scope
2. Difference between sheep and goat-Common terminologies
3. Goat breeds and its classification
4. Sheep Breeds and its classification
5. Economic traits in Sheep and goat
6. Breeding management- oestrus cycle- seasonally polyestrous animal
7. Types of breeding- Natural and Artificial
8. Pregnancy diagnosis
9. Controlled breeding
10. Systems of rearing- extensive, intensive, semi intensive
11. Sedantry- nomadic- transhuman- pastoralism- silvipasture
12. Tethering and Integrated farming system
13. Housing management - Floor space requirements- selection of site
14. Pen, Run and Elevated slat system
15. Care and management of new born kids and lambs
16. Care and management of weanlings
17. **Mid -Semester Examination**
18. Care and management of pregnant and lactating ewes and does
19. Care and management of breeding buck and ram
20. Feeding management
21. Grazing behavior in sheep and Goat. Grazing Vs Browsing.
22. Role of silvipasture and Agro forestry in present scenario- tree lopping
23. Scientific feeding of sheep and goat
24. Flushing Vs steaming up- fattening

25. Signs of health
26. Disease- classification with examples
27. Pregnancy to xaemia and its prevention
28. Control of endo and ectoparasites
29. General control measures of diseases
30. Vaccination schedule
31. Caprine milk, composition and its importance
32. Mutton Vs Chevon- composition and nutritive value
33. Slaughtering methods-Dressing percentage and meat processing
34. Preservation of Meat and Current stream of thoughts.

Practical Schedule

1. External parts of goat/sheep
2. Identification methods in goat and sheep
3. Restraining methods in sheep / goat
4. Castration and hoof trimming
5. Judging of goats
6. Dentition in goats
7. Type and design of goat house
8. Identification of Does in oestrus
9. Demonstration of AI in Does/ Ewes
10. Recording physiological parameters in goat
11. Control of Endoparasites
12. Control of Ectoparasites
13. Identification of feeds and fodders
14. Economic traits of goat/ Sheep
15. Maintenance of goat farm records
16. Dressing of goat
17. **Practical Examination**

Course Outcome

CO 1: To gain knowledge in basic concepts of scientific rearing of caprines and ovines.

CO 2: To understand the basic ideas of goat and sheep management including feeding,breeding and housing

CO 3: Analyze and solve the different problems in goat and sheep management**CO 4:** This course encompasses all relevant information and serve as source of knowledge to understand the modern techniques used in goat and sheep farming.

CO 5: Demonstrate the importance of meat products and processing of meat.

CO-PO Mapping Matrix

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	**3**	**-**	**3**	**2**	**2**	**-**
CO 2	**3**	**-**	**3**	**2**	**-**	**1**
CO 3	**3**	**-**	**2**	**1**	**-**	**2**
CO 4	**2**	**-**	**2**	**2**	**3**	**-**
CO 5	**2**	**-**	**1**	**1**	**1**	**-**

References

1. Handbook of Goat Farming, 2016. Engineers India Research Institute Publishers, NewDelhi 06.
2. Hanumantha Rao.C.,2004. Hand Book on Sheep and Goat Production. A.P.Veterinarycouncil, Hyderabad-28.

3. Jagdish Prasad., 2011. Goat, Sheep and Pig Production and Management, Kalyani Publishers, New Delhi.
4. Jindal.S.K., 2013. Goat Production and Health Management, New India PublishingAgency, New Delhi -88
5. Sastry, N.S.R and C.K. Thomas, 2021. Livestock Production Management, Sixth edition,Kalyani Publishers, Darya Ganj, New Delhi-2.

e-resources

1. https://www.jica.go.jp/nepal/english/office/others/c8h0vm0000bjww96-att/tm_7.pdf
2. https://aces.nmsu.edu/pubs/_circulars/CR604.pdf
3. http://lms.tanuvas.ac.in/course/view.php?id=43
4. https://goats.extension.org/tag/goat-management/
5. https://egyankosh.ac.in/bitstream/123456789/69017/1/Unit-3.pdf

VI &VIII Semesters

Student READY (Rural and Entrepreneurship Awareness Development Yojana) toassure employability and to develop entrepreneurs

This will be undertaken by the students during the seventh and eighth semesters. Student READY shall be run for full year by making two groups and rotating activities of the final yearin two groups. To get the eligibility for registering for the Student READY programme, the students should have completed all the courses successfully up to Sixth semester. Nostudent should be allowed to take up the Student READY programme with backlog/repeat courses.

The students will be required to have registered for the three components listed below. The minimum attendance required for this programme is 85%. Any student in the event of recording shortage of attendance has to re-register the EL when offered next by paying the assigned fee.

1. Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
2. Rural Agricultural Work Experience (RAWE) 10 credits (10 weeks)
3. In Plant Training/Industrial attachment - 10 credits (10 weeks)

The Experiential Learning (EL) /Hands on Training (HOT)

Experiential Learning/Hands on Training (HOT) helps the student to develop competence, capability, capacity building, acquiring skills, expertise, and confidence to start their ownenterprise and turn job creators instead of job seekers. EL provides the students an excellent opportunity to develop analytical and entrepreneurial skills, and knowledge throughmeaningful hands on experience, confidence in their ability to design and execute projectwork.

The main objectives of EL are:

- To promote professional skills and knowledge through meaningful hands on experience
- To build confidence and to work in project mode
- To acquire enterprise management capabilities

The Experiential Learning (EL) shall be run for full year by making two groups and rotating activities of the final year in two groups.

The students will register for any of two modules, listed below, of 0+10 credit hours each. A separate certificate should be issued to the students after successful completion of EL.Allotment of EL amongst students to different modules should be done strictly on the basis of merit at the end of sixth semester.

1	23 ELAGR 401	Agriculture Waste Management	Agronomy	0+10
2	23 ELAGR 402	Organic Production Technology	Agronomy	0+10
3	23 ELGPB 401	Seed Production and Technology	Genetics and Plant Breeding	0+10
4	23 ELAGM 401	Production Technology for Bioagents and Biofertilizer	Agricultural Microbiology	0+10
5	23 ELPAT 401	Mushroom Cultivation Technology	Plant Pathology	0+10

6	23 ELSAC 401	Soil, Plant, Water and Seed Testing	Soil Science and Agricultural Chemistry	0+10
7	23 ELENT 401	Commercial Beekeeping	Entomology	0+10
8	23 ELENT 402	Commercial Sericulture	Entomology	0+10
9	23 ELAHS 401	Poultry Production Technology	Animal husbandry	0+10
10	23 ELHOR 401	Commercial Horticulture	Horticulture	0+10
11	23 ELHOR 402	Floriculture and Landscaping	Horticulture	0+10

Periodical evaluation of the above course will be done by the course teacher during different stages of work. Final evaluation of the above course will be done by the teacher in charge andanother staff member appointed as examiner by the Head of the Department. The finalexamination will be conducted by the University before the commencement of regular final semester examinations.

S.No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Entrepreneurship Skills	10
7.	Technical Skill Development/ Business networking skills	20
8.	Report Writing Skills	10
9.	Final Presentation	10
	Total	**100**

Rural Agricultural Work Experience (RAWE) and Industrial Attachment (IA) (Village/ Industrial Attachment Training Programme)

It shall be undertaken by the students during the seventh/eighth semesters for a total duration of 20 weeks with a weightage of 0+20 credit hours in two parts. The Rural Agricultural Work Experience (RAWE) helps the students primarily to understand the rural situations, status of agricultural technologies adopted by the farmers to prioritize the farmers problems and to develop skills & attitude of working with farm families for overall development in rural area.The timings for RAWE can be flexible for specific regions to coincide with the main cropping season.

It will consist of general orientation and on-campus training by different faculties followed by village attachment/unit attachment in university/college/KVK/estates or a research station. Thestudents would be attached with the horti-industries to get an experience of the industrial environment and working. Due weightage in terms of credit hours will be given dependingupon the duration of stay of students in villages/horti-industries. At the end of RHWE/IA, the students will be given one week for project report preparation, presentation and evaluation. The students would be required to record their observations in field and horti-industries on daily basis and will prepare their project report based on these observations.

23 RAWE & IA - Rural Agricultural Work Experience and Industrial Attachment

Activities	Department	No. of weeks	Credit Hours
General orientation & On campus training by different faculties	Agricultural Extension	1	9
Village attachment		8	

Unit attachment in Univ./College. KVK/ Estates/Research Station /Financial Inst.	Agricultural Economics	5	9
Agri clinic/Agri business center		4	
Agro-Industrial Attachment			
Project Report Preparation, Presentation and Evaluation	Agricultural Extension & Agricultural Economics	2	2
Total weeks for RAWE & AIA		**20**	**20**
23 EXT 411 Educational Tour II	Agricultural Extension		1(0+1)

Industrial Attachment:
The students would be attached with the Agro-Industries based industries for a period of 3 weeks to get an experience of the industrial environment and working.

RAWE Component-I

Village Attachment Training Programme

Sl. No.	Activity	Duration
1.	Orientation and Survey of Village	1 week
2.	Agronomical Interventions	1 week
3.	Plant Protection Interventions	1 week
4.	Soil Improvement Interventions (Soil sampling and testing)	1 week
5.	Fruit and Vegetable production interventions	1 week
6.	Food Processing and Storage interventions	1 week
7.	Animal Production Interventions	1 week
8.	Extension and Transfer of Technology activities	1 week

23 RAWE Component –II

Agri-Industrial Attachment

- Students shall be placed in Agro and Cottage industries and Commodities Boards for03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing value addition, Agri-finance institutions, etc

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on training under supervision of industrystaff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

The final examination will be conducted separately at the end of the semester by theUniversity. The marks will be awarded as detailed below.

Particulars	Max marks	Evaluation by
Observation Note book	20	By Teacher in-charge
Skills learned	20	
Final examination		
Commendable activities	10	By the Examiners
Detailed project report presentation and Record	30	
Viva Voce	20	
Total	**100**	