INSTITUTE OF AGRICULTURE RESEARCH AND TECHNOLOGY (IART)

BACHELOR OF SCIENCE (HONS.) AGRICULTURE

Academic Regulations and Syllabi

Under Choice Based Credit System (CBCS)with Outcome based Education

2023-24 Onwards

NMV UNIVERSITY

Institute of Agriculture Research and Technology (IART)

B.Sc. (Hons.) Agriculture

(With effect from 2023-2024)

1. Title and scope

1.1. These Academic Regulations shall be called "NMV University, Institute of Agriculture Research & Technology, B.Sc. (Hons) Agriculture Academic Regulations 2023" for obtaining bachelor's degree in the Institute of Agriculture Research & Technology.

1.2. The regulations provided herein shall apply to the students admitted from theacademic year 2023-24 onwards.

2. Definitions

2.1. **University:** University means NMV University, Chennai, Tamil Nadu.

2.2. **Academic Year:** An academic year is a period during which a cycle of study is completed. 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.

2.3. **Semester:** A semester shall consist of 105 working days including examinations.

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

2.5. **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.

2.6. **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.

2.7. **Credit Load:** It is the number of credits a student undergoes in a semester.

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

2.9. **Credit Point:** A credit point is the product of grade point obtained by a student and numberof credits in a course.

2.10. **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 during that semester.

2.11. **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 scaleup to the second decimal place.

2.12. The OGPA shall be rounded off to the second digit of decimal point on the basis of third digit. If the third digit of 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.

2.13. **Calculation of OGPA:** To arrive 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 the course to obtain the credit points. Then, the sum of 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 of courses 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

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

3. Admission

3.1. Admission of the student to B.Sc. (Hons.) Agriculture programme in the Institute of Agriculture Research & Technology (IART) shall be on the basis of merit and in accordance with the policy and guidelinesof the state government and the University. The minimum admission requirement shall be decided by the University and issued from time to time. The decision of the University is final in deciding procedure of admission and finalization of number of seats. Reservation rules shall be made applicable as per norms of the state government.

3.2. **Tuition fees:** The various fees payable by the students will be decidedby the University from time to time.

a) In case of new admission, fees for the semester are payable in advance failing which they will not be admitted.
b) In other cases, the fees are payable within seven working days from the commencement of the semester.
c) In the case of default, a fine as per the University rules will be collected.
d) The candidate should obtain a Hall Ticket from the Controller of Examinations through the Dean after clearing all arrears including the hostel dues before the commencement of each semester final examination.

4. Advisory system

4.1. The Dean shall nominate a Coordinator from amongst the teaching faculty for each year.

4.2. Student Ward Counsellors will be nominated soon after the students' admission. The Counsellor shall be nominated from amongst the teaching faculty.

4.3. 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.

5. Curriculum and Programme of study

The Students admitted in the University shall be required to follow the curriculum as prescribed, revised by the Faculty and approved by the Academic Council from time to time.

6. Award of Degree, duration and credit requirements

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

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

7. Medium of Instruction

The medium of Instruction in the IART shall be English.

8. Attendance Requirements

8.1. One hundred per cent attendance is expected from each student. A student who fails to secure 80 per cent of attendance prescribed for a course of study, separately in theory and practical shall not be permitted to appear for both theory and practical examinations in that course and shall be given 'E' (incomplete) and will be required to repeat the course when offered again.

8.2. For the first year first semester students, for calculating 80 per cent attendance the number of working days will be calculated only from the date of joining of the student.

8.3. If any student is absent for field trips, the student may be marked absent for all the compensating classes on the day of the field trip in addition to the field trip courses.

8.4. The attendance for mid semester examination will be counted as a theory class.

8.5. Students abstaining from the classes by prior permission from the Dean, IART on Official University business, shall be given due consideration in computing attendance requirements.

8.6. However, condonation of attendance deficiency may be considered by the Vice-Chancellor only in case the student secures minimum 50 per cent of attendance in practical and theory classes and that to for genuine medical reasons including indoor hospitalization with evidence in the form of Hospitalization certificate and Discharge summary recommended by the Dean, Institute of Agriculture Research & Technology. The Vice–Chancellor may decide whether a condonation fee is required, based on the reason for condonation.

8.7. The student belonging to a batch will attend classes and earn attendance in the particular batch only as per the time table. No student shall be permitted to attend along with another batch to gain attendance either in theory or in practical.

9. Examinations

Each course shall carry a maximum of 100 marks for the purpose of grading.

The distribution of marks shall be as follows.

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

9.2 Course with only Theory / Practical	Marks
Mid Semester Examination	40
Final Semester Examination	60
Total	**100**

9.3. The students should register for the examination and shall pay the examination fees as prescribed by the university from time to time.

9.4. **Evaluation of Course work:** The results of the course shall be indicated by grade points ranging from 0 to 10.0. The minimum grade point to be secured for the successful completion of a course will be 6.00. Securing a grade point less than 6.00 in a course will be treated as 'RA' and the grade point will be 0 for calculating the GPA/OGPA. In case of course with theory and practical, minimum of 60 per cent mark separately in theory and practical with an aggregate of 60 per cent is essential. An OGPA of 6.50 shall be the minimum requirement for the award of Degree.

The following symbols shall be used in the grade sheets.

E	Incomplete (due to attendance deficiency)
AB	Absent
RR	Re-registration
RA	Re-appearance
EE	Incomplete for reasons other than attendance

9.5. **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 Practices (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 for physical 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 conducted in the last practical class of the second semester and the course teacher shall send the marks awarded to the Controller of Examinations through the Dean, Institute of Agriculture Research & Technology.

Particular	Physical Education	Yoga Practices	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.

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 and onespecial

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, IART. Activities directed by the Centraland 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 paradesin four semesters. Marks will be awarded at the rate of two and half marks per parade (2.5 x 40 = 100).

c. AGR 302 Practical Crop Production –I (*Kharif* Crops) & AGR 304 Practical Crop Production –II (*Rabi* Crops)

S. No.	Particulars	Mid-Semester Examination	Final Examination
1	Field evaluation	20	20
2	Written examination	20	25
3	Record	-	5
4	Assignment	-	5
5	*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 and final year, respectively. The duration of AGR 211 shall not exceed 7 days and that of EXT 411shall not exceed 14 days. The tours will be arranged by the respective departments of the study in consultation with the Dean, IART. The final examination will beconducted at end of the semester by the University. The marks for the tours are to beawarded as follows

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 years by making two groups and rotating activities of 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 per cent 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.

Experiential Learning (EL)/Hands on Training (HOT) - 20 credits (24 weeks)
Rural Agricultural Work Experience (RAWE) 10 credits (10 weeks)
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 opportunity to develop entrepreneurial skills through 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- Head of the Department
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

10. Mid-Semester Examination (MSE)

10.1. MSE will be conducted as per the Time table prepared by the Dean, IART. 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.

10.2. 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 the Dean, IART on payment of fee prescribed by the University. MSE will be conducted by the Dean, IART. 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 tothe students.

10.3. 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.

10.4. The MSE marks will be furnished to the Dean, IART 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 working days 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 department concerned shall be nominated by the Dean.

10.5. The MSE for courses with both theory and practical will be one hour duration and for courses with only theory will be one and half 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 practical, 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**

10.6. 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.

10.7. 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 to reappear 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.

11. Final Theory Examination (FTE)

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

11.2. Theory examinations will be conducted after practical examinations.

11.3. The question papers for the final theory examinations will be set as per Bloom's taxonomy by the External examiner nominated by the Controller of the examination.

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
iii.	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 represent K7 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 represent K6 level of Blooms taxonomy)	25
	Total	**60**

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

11.5. **Final Practical examination (FPE)** will be conducted separately towards the end of each semester. Practical examination will be conducted separately as per the schedule proposed by the Dean, IART 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**

11.6. A student can be permitted to write either theory or practical or both in reappearance examination for failed subjects.

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

11.8. Two examiners and one skilled assistant nominated by Head of the Department and recommended by the Dean, IART.

11.9. Students should possess hall ticket for writing practical and final examinations.

12. Re-appearance in the Examination

12.1. As per the clause 11.6 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 to any number of times during n+4 years duration excluding the regular final examination. In the event of a student failing to secure a pass in any number re-examinations permitted during n+4 years, he/she has to re-register the course along with juniors.

12.2. In order to register III year courses (5th Semester onwards), a student should have completed all the registered I year (Semester 1 & 2) courses successfully.

12.3. In order to register for final year courses (7th Semester onwards), a student should have successfully completed all first and second year courses (Semester 1, 2, 3 & 4) registered.

12.4. 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.

12.5. 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.

12.6. Those who miss the study tours for any valid reason must undertake the tour along with juniors to complete the degree programme.

12.7. 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 for more than 16 subjects in the reappearance examination at a time.

12.8. The candidates for the reappearance examinations will submit their applications through the Dean, IART 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.

13. Malpractices in Examination

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

13.2. 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.

13.3. The Dean shall take appropriate steps on receipt of the report and the report will be sent to the Controller of Examinations for appropriate action as prescribed by the University.

14. Regulations of student conduct and discipline

14.1. **Ragging Rules:** Students found involved in ragging or in any other misconduct, or if a complaint is received from the affected student(s) to that effect, will be immediately expelled from the current semester and the Dean shall further constitute a committee to probe and conduct enquiry into the matter and based on the report of the committee, the Dean shall forward the same to the Registrar to pass the final orders on merit of case within three working days.

14.2. Unlawful Activities: In case of students found involved in any unlawful activities either within or outside the Hostel/College Campus, besides expulsion both from the Hostel and College, at the discretion of the Dean with the knowledge of the Registrar, the matter will be reported to the Police of the jurisdiction to be dealt with, in accordance with the appropriate law in force.

14.3. Ragging – An offence: Extract of Tamil Nadu Government Gazette – Extra ordinary dt. 29.01.1997 (Tamil Nadu Prohibition of Ragging Act, 1997). In this Act, unless the context otherwise requires, "Ragging" means display of noisy, disorderly conduct, doing any act which causes or is likely to cause physical or psychological harm or raises apprehension or fear or shame or embarrassment to a student in any educational Institution and includes: teasing, abusing or playing practical jokes on or causing hurt to such student or asking the student to so any act or perform something which such student will not, in the ordinary course willingly act or perform. Ragging within or outside any educational institution is prohibited. Whoever directly or indirectly commits, participates in, abets or propagates "Ragging" within or outside any educational institution, shall be punished with imprisonment for a term which may extend to two years and shall also be liable to fine which may extend to ten thousand rupees.

Any student convicted of an offence under section 4 shall also be dismissed from the educational institution and such students shall not be admitted in any other educational institution. Without prejudice to the foregoing provision, whenever any student complains of ragging to the head of an educational institution, or to any other person responsible forthe management of the educational institution, such head of the educational institution or person responsible for the management of the educational institution shall inquire into the same immediately and if found true shall suspend the student who has committed the offence from the educational institution.

On the recommendation of the Dean, Institute of Agriculture Research & Technology, the Registrar will have full powers to punish any student who violates the rules by imposing a fine, suspension or expulsion. His decision is final and he need not assign any reason or explanation for thepunishment awarded.

These rules will be altered or amended, and further rules may be added if necessary. Allthe rules for the time being in force should be observed by the students.

15. 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 goodconduct and character.

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

16. Percentage equivalence and Class ranking

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

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

In calculation of percentage and class equivalent for OGPA the following classification 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

17. 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 such course/courses are not currently offered due to the introduction of the revised syllabi with effect from the academic year 2021 – 2022. The candidates under old semester systemwill, however, complete all the examinations within a period of eight academic years from the year of admission.

18. 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, weather analysis, irrigation and nutrient management.
3. Graduates will be successful professionals in agro-industries with problem solving skills, critical thinking, market intelligence and decision-making and will be able to organize, 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 commercial aspects of agriculture.
5. Graduates will learn appropriate traditional/Indigenous/organic and modern techniques and understand the current problems which are necessary for future goals 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 will have 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

Arrangement of Courses

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

Abstract of Distribution Pattern of Courses and Credit

Semester	Number of Courses	Credit
I	13	23 (15+8)
II	12	25 (15+10)
III	12	24 (14+10)
IV	12	25 (14+11)
V	12	24 (13+11)
VI	11	23 (13+10)
VII	02	20 (0+20)
VIII	02	20 (0+20)
	Total	**184 (84+100)**

Discipline-wise Summary of Credit hours

S. No.	Discipline	Credit
1.	Agronomy	18 (8+10)
2.	Genetics and Plant Breeding	16 (10+6)
3.	Soil Science and Agricultural Chemistry	12 (7+5)
4.	Entomology	11 (6+5)
5.	Plant Pathology	12 (8+4)
6.	Horticulture	10 (5+5)
7.	Agricultural Economics	11 (7+4)
8.	Agricultural Extension Education	9 (6+3)
9.	Agricultural Engineering	8 (4+4)
10.	Animal Production	3 (2+1)
11.	Agricultural Microbiology	3 (2+1)
12.	Environmental Sciences	3 (2+1)
13.	Food Science and Technology	2 (1+1)
14.	Agroforestry	2 (1+1)
15.	Plant Biochemistry	2 (1+1)
16.	Plant Biotechnology	2 (1+1)
17.	Statistics	2 (1+1)
18.	Computer Application	2 (1+1)
19.	Language	3 (3+0)
20.	Remedial Courses*	4 (2+2)*
21.	Elective courses	9 (6+3)
22.	RAWE and ELP	40 (0+40)
	Total	**184 (84+100)**
23.	Non-Gradial Compulsory Courses**	5 (1+4)**

DEPARTMENT WISE LIST OF COURSES

1. AGRONOMY

S. No.	Semester	Course code	Title	Credit
1.	I	AGR 101	Fundamentals of Agronomy and Agricultural Heritage	2(1+1)
2.	II	AGR 102	Introductory Agro-Meteorology and Climate change	2(1+1)
3.	III	AGR 201	Crop production technology-I (*Kharif* Crops)	2(1+1)
4.	III	AGR 202	Irrigation and Weed Management	2(1+1)
5.	IV	AGR 203	Crop production technology-I (*Rabi* Crops)	2(1+1)
6.	IV	AGR 204	Farming systems and sustainable agriculture	2(1+1)
7.	V	AGR 301	Rainfed Agriculture and Watershed Management	2(1+1)
8.	V	AGR 302	Practical Crop Production -I (*Kharif* Crops)	1(0+1)
9.	VI	AGR 303	Principles of Organic Farming	2(1+1)
10.	VI	AGR 304	Practical Crop Production –II (*Rabi* Crops)	1(0+1)
			Total	**18 (8+10)**

2. GENETICS AND PLANT BREEDING

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

3. SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

S. No.	Semester	Course code	Title	Credit
1.	I	SOL 101	Fundamentals of Soil Science	3(2+1)
2.	II	SOL 102	Manures, Fertilizers and Soil Fertility Management	3(2+1)
3.	III	SOL 201	Problem Soils and their management	2(1+1)
4.	IV	SOL 202	Soil Resource Inventory	2(1+1)
5.	V	SOL 301	Geo-informatics, Nanotechnology and Precision farming	2(1+1)
			Total	**12 (7+5)**

4. ENTOMOLOGY

S. No.	Semester	Course code	Title	Credit
1.	II	ENT 101	Fundamentals of Entomology	3(2+1)
2.	III	ENT 201	Beneficial Insects and Principles of Integrated Pest Management	3(2+1)
3.	IV	ANM 201	Introductory Nematology	1(1+0)
4.	V	ENT 301	Pests of Field Crops and Stored Produces and their Management	2(1+1)
5.	VI	ENT 302	Pests of Horticultural Crops and Stored Produces and their Management	2(1+1)
			Total	**11 (7+4)**

5. PLANT PATHOLOGY

S. No.	Semester	Course code	Title	Credit
1.	III	PAT 201	Fundamentals of Plant Pathology	3(2+1)
2.	IV	PAT 202	Principles of Integrated Plant Disease Management	3(2+1)
3.	V	PAT 301	Diseases of Field and Horticultural Crops and their Management-I	3(2+1)
4.	VI	PAT 303	Diseases of Field and Horticultural Crops and their Management -II	3(2+1)
			Total	**12 (8+4)**

6. HORTICULTURE

S. No.	Semester	Course code	Title	Credit
1.	I	HOR 101	Fundamentals of Horticulture	2(1+1)
2.	II	HOR 102	Production Technology for Fruits and Plantation Crops	2(1+1)
3.	III	HOR 201	Production Technology for Vegetables and Spices	2(1+1)
4.	IV	HOR 202	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
5.	V	HOR 301	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)
			Total	**10 (5+5)**

7. AGRICULTURAL ECONOMICS

S. No.	Semester	Course code	Title	Credit
1.	II	AEC 101	Fundamentals of Agricultural Economics	2(1+1)
2.	III	AEC 201	Farm Management, Production & Resource Economics	2(1+1)
3.	IV	AEC 202	Agricultural Marketing, Trade & Prices	2(1+1)
4.	V	AEC 301	Agri-Business Management	2(1+1)
5.	V	AEC 302	Intellectual Property Rights	1(1+0)
6.	VI	AEC 303	Agricultural Finance, Banking and Cooperation	2(1+1)
			Total	**11 (6+5)**

8. AGRICULTURE EXTENSION EDUCATION

S. No.	Semester	Course code	Title	Credit
1.	I	EXT 101	Rural Sociology & Educational Psychology	2(2+0)
2.	II	EXT 102	Fundamentals of Agricultural Extension Education	3(2+1)
3.	V	EXT 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)**

9. AGRICULTURAL ENGINEERING

S. No.	Semester	Course code	Title	Credit
1.	II	AEG 101	Soil and Water Conservation Engineering	2(1+1)
2.	III	AEG 201	Farm Machinery and Power	2(1+1)
3.	IV	AEG 202	Renewable Energy and Green Technology	2(1+1)
4.	VI	AEG 301	Protected Cultivation and Secondary Agriculture	2(1+1)
			Total	**8 (4+4)**

10. ANIMAL PRODUCTION

S. No.	Semester	Course code	Title	Credit
1.	IV	AMP 201	Livestock and Poultry Management	3(2+1)
			Total	**3 (2+1)**

11. AGRICULTURAL MICROBIOLOGY

S. No.	Semester	Course code	Title	Credit
1.	II	AGM 101	Agricultural Microbiology	3(2+1)
			Total	**3 (2+1)**

12. ENVIRONMENTAL SCIENCES

S. No.	Semester	Course code	Title	Credit
1.	III	ENS 201	Environmental Studies and Disaster Management	3(2+1)
			Total	**3 (2+1)**

13. FOOD SCIENCE AND TECHNOLOGY

S. No.	Semester	Course code	Title	Credit
1.	II	FSN 101	Principles of Food Science and Nutrition	2(1+1)
			Total	**2 (1+1)**

14. AGROFORESTRY

S. No.	Semester	Course code	Title	Credit
1.	I	FOR 101	Introduction to Forestry and Agroforestry	2(1+1)
			Total	**2 (1+1)**

15. PLANT BIOCHEMISTRY

S. No.	Semester	Course code	Title	Credit
1.	I	BIC 101	Fundamentals of Plant Biochemistry	2(1+1)
			Total	**2 (1+1)**

16. PLANT BIOTECHNOLOGY

S. No.	Semester	Course code	Title	Credit
1.	VI	ABT 301	Plant Biotechnology	2(1+1)
			Total	**2 (1+1)**

17. STATISTICS

S. No.	Semester	Course code	Title	Credit
1.	V	STA 301	Statistical methods	2(1+1)
			Total	**2 (1+1)**

18. COMPUTER APPLICATION

S. No.	Semester	Course code	Title	Credit
1.	VI	COM 301	Agro-Informatics	2(1+1)
			Total	**2 (1+1)**

19. LANGUAGE

S. No.	Semester	Course code	Title	Credit
1.	I	ENG 101	Comprehension and Communication Skills in English	2(2+0)
2.	I	TAM 111/ ENG 111	தமிழ் இலக்கியங்களில் வேளாண் மையுைள் அறிவியல் தமிழ் பயன் பாடுைள் / Development Education	1(1+0)
			Total	**3 (3+0)**

20. REMEDIAL COURSES

S. No.	Semester	Course code	Title	Credit
1.	I	MAT 111	Elementary Mathematics	2(1+1)
2.	I	GPB 111	Introduction to Agricultural Botany	2(1+1)
			Total	**4 (2+2)**

21. ELECTIVE COURSES

S. No.	Semester	Course code	Title	Credit
1.	IV	EC-I	Elective Courses - I	3(2+1)
2.	V	EC-II	Elective Courses - II	3(2+1)
3.	VI	EC-III	Elective Courses - III	3(2+1)
			Total	**9 (6+3)**

22. RAWE & ELP COURSES

S. No.	Semester	Course code	Title	Credit
1.	VII	EXT 401	RAWE- Rural Agricultural Work Experience	10(0+10)
2.	VII	AEC 401	AIA- Agro- Industrial Attachment	10(0+10)
3.	VIII	ELP	Module I & II	20(0+20)
			Total	**40 (0+40)**

23. NON-GRADIAL COMPULSORY COURSES

S. No.	Semester	Course code	Title	Credit
1.	I, II, III & IV	NSS 111*/ NCC 111*	National Service Scheme/ National Cadet Corps	1(0+1)*
2.	I & II	PEY 111*	Physical Education and Yoga Practices	1(0+1)*
3.	III	EXT 211*	Human Values and Ethics	1(1+0)*
4.	IV	AGR 211*	Educational Tour -I	1(0+1)*
5.	VII	EXT 411*	Educational Tour - II	1(0+1)*
			Total	**5 (1+4)***

ELECTIVE COURSES

A student can select three courses out of the following elective courses offered during 4th, 5th and 6th semesters. Student will select 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	EC AGR305	System Simulation and Agro-advisory	3 (2+1)
2.	Genetics and Plant Breeding	EC GPB302	Commercial Plant Breeding	3 (2+1)
3.	Soil Science and Agricultural Chemistry	EC SOL203	Agrochemicals	3 (2+1)
4.	Entomology	EC ENT202	Urban Entomology	3 (2+1)
5.	Plant Pathology	EC PAT302	Antagonistic formulations	3 (2+1)
6.	Horticulture	EC HOR302	Hi-tech Horticulture	3 (2+1)
7.	Agricultural Microbiology	EC AGM201	Bio pesticides and Bio Fertilizers	3 (2+1)
8.	Agricultural Economics	EC AEC304	Project Management	3 (2+1)
9.	Agricultural Extension	EC EXT303	Agricultural Journalism	3 (2+1)

EXPERIENTIAL LEARINING PROGRAMME (ELP)

S. No.	Department	Code	Courses	Credit
1.	Agronomy	EL AGR 401	Agriculture Waste Management	10(0+10)
2.	Agronomy	EL AGR 402	Organic Production Technology	10(0+10)
3.	Genetics and Plant Breeding	EL GPB 401	Seed production Technology	10(0+10)
4.	Soil Science Agricultural Chemistry	EL SOL 401	Soil, Plant, Water and Seed Testing	10(0+10)
5.	Entomology	EL ENT 401	Commercial Beekeeping	10(0+10)
6.	Entomology	EL ENT 402	Commercial Sericulture	10(0+10)
7.	Plant Pathology	EL PAT 401	Mushroom Cultivation Technology	10(0+10)
8.	Agricultural Microbiology	EL AGM 401	Bio-inoculant Production Technology	10(0+10)
9.	Horticulture	EL HOR 401	Commercial Horticulture	10(0+10)
10.	Horticulture	EL HOR 402	Floriculture and Landscaping	10(0+10)
11.	Agricultural Engineering	EL AEG 401	Food Processing Technology	10(0+10)
12.	Animal Production	EL AMP 401	Poultry Production Technology	10(0+10)

SEMESTER WISE CURRICULUM

I SEMESTER

S. No.	Course code	Courses	Credit
1.	AGR 101	Fundamentals of Agronomy and Agricultural Heritage	2 (1+1)
2.	CRP 101	Fundamentals of Crop Physiology	3 (2+1)
3.	SOL 101	Fundamentals of Soil Science	3 (2+1)
4.	FOR 101	Introduction to Forestry and Agro-forestry	2 (1+1)
5.	BIC 101	Fundamentals of Plant Biochemistry	2 (1+1)
6.	HOR 101	Fundamentals of Horticulture	2 (1+1)
7.	EXT 101	Rural Sociology and Educational Psychology	2 (2+0)
8.	ENG 101	Comprehension and Communication Skills in English	2 (2+0)
9.	MAT 111	Elementary Mathematics	2 (1+1)
10.	GPB 111	Introduction to Agricultural Botany	2 (1+1)
11.	TAM 111/ ENG 111	தமிழ் இலக்கியங்களில் வேளாண் மையுைை அறிவியல் தமிழ் பயன் பாடுைை / Development Education	1(1+0)
12.	NSS 111*/ NCC 111*	National Service Scheme/ National Cadet Corps	1(0+1)*
13.	PEY 111*	Physical Education and Yoga Practices	1(0+1)*
		TOTAL	**23 (15+8)**

II SEMESTER

S. No.	Course code	Courses	Credit
1.	AGR 102	Introductory Agro-meteorology and Climate Change	2(1+1)
2.	AGM 101	Agricultural Microbiology	3(2+1)
3.	GPB 101	Fundamentals of Genetics	3(2+1)
4.	SOL 102	Manures, Fertilizers and Soil Fertility Management	3(2+1)
5.	ENT 101	Fundamentals of Entomology	3(2+1)
6.	HOR 102	Production Technology of Fruits and Plantation Crops	2(1+1)
7.	FSN 101	Principles of Food Science and Nutrition	2(1+1)
8.	AEC 101	Fundamentals of Agricultural Economics	2(1+1)
9.	EXT 102	Fundamentals of Agricultural Extension Education	3(2+1)
10.	AEG 101	Soil and Water Conservation Engineering	2(1+1)

11.	NSS 111*/ NCC 111*	National Service Scheme / National Cadet Corps	1(0+1)*
12.	PEY 111*	Physical Education And Yoga Practices	1(0+1)*
		TOTAL	**25(15+10)**

III SEMESTER

S. No.	Course code	Courses	Credit
1.	AGR 201	Crop Production Technology – I (*Kharif* Crops)	2 (1+1)
2.	AGR 202	Irrigation and Weed Management	2 (1+1)
3.	GPB 201	Fundamentals of Plant Breeding	3 (2+1)
4.	SOL 201	Problematic Soils and their Management	2 (1+1)
5.	ENT 201	Beneficial Insects and Principles of Integrated Pest Management	3 (2+1)
6.	PAT 201	Fundamentals of Plant Pathology	3 (2+1)
7.	ENS 201	Environmental Studies and Disaster Management	3 (2+1)
8.	HOR 201	Production Technology of Vegetables and Spices	2 (1+1)
9.	AEC 201	Farm Management, Production and Resource Economics	2 (1+1)
10.	AEG 201	Farm Machinery and Power	2 (1+1)
11.	EXT 211*	Human Values and Ethics	1 (1+0)*
12.	NSS 111*/ NCC 111*	National Service Scheme / National Cadet Corps	1 (0+1)*
		TOTAL	**24 (14+10)**

IV SEMESTER

S. No.	Course code	Courses	Credit
1.	AGR 203	Crop Production Technology – II (*Rabi* Crops)	2 (1+1)
2.	AGR 204	Farming System and Sustainable Agriculture	2 (1+1)
3.	GPB 202	Principles of Seed Technology	3 (2+1)
4.	SOL 202	Soil Resource Inventory	2 (1+1)
5.	PAT 202	Principles of Integrated Plant Disease Management	3 (2+1)
6.	ANM 201	Introductory Nematology	1 (1+0)
7.	HOR 202	Production Technology of Ornamental Crops, MAP and Landscaping	2 (1+1)

8.	AEC 202	Agricultural Marketing, Trade & Prices	2 (1+1)
9.	AEG 202	Renewable Energy and Green Technology	2 (1+1)
10.	AMP 201	Livestock and Poultry management	3 (2+1)
11.	EC - I EC ENT 202 EC AGM 201 EC SOL 203	**Elective Courses – I** Urban Entomology Biopesticides and Biofertilizers Agrochemicals	3 (2+1)
12.	AGR 211*	Educational Tour –I	1 (0+1)*
13.	NSS 111*/ NCC 111*	National Service Scheme / National Cadet Corps	1 (0+1)*
		TOTAL	**25 (14+11)**

V SEMESTER

S. No.	Course code	Courses	Credit
1.	AGR 301	Rainfed Agriculture and Watershed Management	2 (1+1)
2.	AGR 302	Practical Crop Production- I (*Kharif* Crops)	1 (0+1)
3.	GPB 301	Crop Improvement- I (*Kharif* Crops)	2 (1+1)
4.	SOL 301	Geo-Informatics, Nanotechnology and Precision Farming	2 (1+1)
5.	ENT 301	Pests of Field Crops and Stored Produces and their Management	2 (1+1)
6.	PAT 301	Diseases of Field and Horticultural Crops and their Management-I	3 (2+1)
7.	HOR 301	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)
8.	AEC 301	Agri-Business Management	2 (1+1)
9.	AEC 302	Intellectual Property Rights	1 (1+0)
10.	EXT 301	Communication Skills and Personality Development	2 (1+1)
11.	STA 301	Statistical Methods	2 (1+1)
12.	EC - II EC PAT 302 EC GPB 302 EC HOR 302	**Elective Courses – II** Antagonistic Formulations Commercial Plant Breeding Hi-tech Horticulture	3 (2+1)
		TOTAL	**24 (13+11)**

VI SEMESTER

S. No.	Course code	Courses	Credit
1.	AGR 303	Principles of Organic Farming	2 (1+1)
2.	AGR 304	Practical Crop Production- II (*Rabi* Crops)	1 (0+1)
3.	GPB 303	Crop Improvement- II (*Rabi* Crops)	2 (1+1)
4.	ENT 302	Pests of Horticultural Crops and Stored Produces and their Management	2 (1+1)
5.	PAT 303	Diseases of Field and Horticultural Crops and their Management -II	3 (2+1)
6.	ABT 301	Plant Biotechnology	2 (1+1)
7.	AEC 303	Agricultural Finance, Banking and Co-Operation	2 (1 +1)
8.	EXT 302	Entrepreneurship Development and Business Communication	2 (1+1)
9.	AEG 301	Protected Cultivation and Secondary Agriculture	2 (1+1)
10.	COM 301	Agro-Informatics	2 (1+1)
11.	EC – III EC AGR 305 EC AEC 304 EC EXT 303	**Elective Courses – III** System Simulation and Agro-advisory Project Management Agricultural Journalism	3 (2+1)
		TOTAL	**23 (13+10)**

VII SEMESTER

S. No.	Course code	Courses	Credit
1.	EXT 401	RAWE - Rural Agricultural Work Experience	10 (0 + 10)
2.	AEC 401	AIA - Agro-Industrial Attachment	10 (0 + 10)
3.	EXT 411*	Educational Tour - II	1 (0+1)*
		TOTAL	**20 (0 +20)**

VIII SEMESTER

S. No.	Course code	Courses	Credit
1.	ELP 401	Module - I	10 (0 + 10)
2.	ELP 402	Module - II	10 (0 + 10)
		TOTAL	**20 (0 +20)**

SEMESTER WISE CURRICULAM
I SEMESTER

AGR 101 FUNDAMENTALS OF AGRONOMY AND AGRICULTURAL HERITAGE (1+1)

Learning 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 - Evolution of man and agriculture – Development of scientific Agriculture - National and International Agricultural Research Institutes - Indian agriculture- Indian economy – National income – Women in agriculture and empowerment. Agronomy – Definition – Meaning and scope

Unit – II History of agricultural development and Heritage

History of agricultural development in the world and India. Agriculture heritage – Agriculture in ancient India – Stages of agriculture development - Era of civilization- Importance of Neolithic civilization - Chronological agricultural technology development in India- Kautilya's Arthasasthra- Sangam literature - ITK-Tamil Almanac and rainfall prediction.

Unit – III Crop distribution and production

Agro-climatic zones of India and Tamil Nadu – Agro ecological zones of India and Tamil Nadu - Crops and their classification –Economic and agricultural importance - Major crops of India and Tamil Nadu - Major soils of India and Tamil Nadu - Factors affecting crop production – climate - edaphic- biotic - physiographic and socioeconomic factors.

Unit – IV Concepts of agricultural operations, planting methods and geometry

Tillage – Definition - Types- Objectives - Modern concepts of tillage – Main field preparations - Seeds - seed rate- sowing methods - Germination – Factors affecting germination - Crop stand establishment - Planting geometry and its effect on growth and yield - After cultivation – Thinning - Gap filling - Inter cultural operations.

Unit – V Weed, nutrient and irrigation management and cropping and farming system

Weeds – Definition – Effects of weeds and management of weeds - IWM Manures and fertilizers – Agronomic interventions for enhancing FUE – Irrigation -Time and methods of irrigation - Modern techniques of irrigation - Drainage and its importance - Cropping patterns and cropping systems - intensive cropping - Crop rotation -Sustainable agriculture- integrated farming systems - Farm enterprises - Organic / eco- friendly agriculture - Concepts and principles – Dry farming- Concepts and principles.

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 treatment practices. 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. Agriculture – Definition – Importance and scope - Branches of agriculture - Evolution of man, and agriculture – Development of scientific agriculture - National and International Agricultural Research Institutes.
2. Indian agriculture- Indian economy – National income – per capita income – Agricultural income in GDP - Women in agriculture and empowerment.
3. History of agricultural development in the world and India. Agriculture heritage – Agriculture in ancient India
4. Stages of agriculture development - Era of civilization- Importance of Neolithic civilization
5. Chronological agricultural technology development in India
6. Kautilya's Arthasasthra- Sangam literature - rainfall prediction -ITK-Tamil Almanac.
7. Agronomy – definition – meaning and scope. Agro-climatic zones of India and Tamil Nadu – Agro ecological zones of India and Tamil Nadu
8. **Mid-semester Examination**
9. Crops and major soils - classification – Economic and agricultural importance in Tamil Nadu and India
10. Factors affecting crop production – climatic – edaphic - biotic- physiographic and socio economic factors
11. Tillage – Definition – objectives – types of tillage - modern concepts of tillage – main field preparation
12. Seeds - Seed rate - sowing methods - Germination - Crop stand establishment - Planting geometry
13. Weeds – Definition – harmful and beneficial effects of weeds – crop weed competition and management of weeds – IWM
14. Role of manures and fertilizers in crop production – agronomic interventions for enhancing FUE - Inter cultivation - Thinning - gap filling and other intercultural operations
15. Irrigation - time and methods - Modern techniques of irrigation - Drainage and its importance.
16. Cropping patterns and cropping system - intensive cropping- sustainable agriculture – IFS
17. Organic / eco-friendly agriculture - Dry farming- concepts and principles

Practical schedule

1. Visit to IART 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 different crops.
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 to modern age

CO 3: To critically assess the inter relationship between crop production and different factors affecting the production of crops

CO 4: To construct skills on basic agricultural operations viz., seeds and sowing, after cultivation practices, irrigation and nutrient management

CO 5: To understand about harvesting, cleaning and storage of agricultural products.

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. Palaniappan S.P. 2009, Principles and Practices of Agronomy, Agribios Publishers, Jodhpur.
2. Chandrasekharan, B., K. Annadurai and E. Somasundaram, 2014, Text Book of Agronomy, New age 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.

CRP 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 from the 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 and Symplast - 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

and its 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 by different methods - Physiological and Nutritional disorders in crops plants -Estimation of chlorophyll 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 and closing – guttation - antitranspirants
6. Mineral nutrition – criteria of essentiality - classification of nutrients – macro, micro, mobile and 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 sink strength 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 breaking methods
28. Senescence and abscission – physiological and biochemical changes
29. Physiology of fruit ripening- climacteric and non-climacteric fruits - factors affecting ripening 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 to crop 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 pigment composition, 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 to Plant Physiology, A.E. Publications. Coimbatore
2. Jain, V.K. 2007. Fundamentals of plant physiology, S.Chand and Company Ltd., New Delhi.
3. Taiz. L. and Zeiger. E., 2010 (Fifth edition). Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.
4. Sabesan, T., S. Suganthi, P. Satheeshkumar and R. Narayanan. 2015. Introduction to Crop 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

SOL 101 FUNDAMENTALS OF SOIL SCIENCE (2+1)

Learning 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 and particle 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 of soil 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 important rocks.
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 components of 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 Subordinate horizons
12. Specific pedogenic processes-Calcification-Decalcification-Salinization- Alkalization-Podzolization-Laterization.
13. Soil taxonomy and its classification - Soils of India and Tamil Nadu
14. Physical properties-Soil texture -Soil separates -Textural analysis -International pipette method-Stoke's law-Assumption and limitations-Textural classes using triangular diagram
15. Soil structure- Classification- types, classes and grades of soil structure- importance of soil 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 of soil pH)
13. Estimation of soil EC (theory and principles of EC meter and principles of estimation in soil 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 minerals
CO 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 health
CO 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

FOR 101 INTRODUCTORY TO FORESTRY AND AGROFORESTRY (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 inproductivity 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 Forestry

Introduction - Definition of Forest and Forestry - Role of Forest (Production, Protection and Amelioration) - Classification of Forest (Regeneration, Age, Composition. ownership, object of management, growing stock) - National Forest Policy 1988.

UNIT II- Silviculture and Forest plantation

Forest regeneration - Natural regeneration- Seeds and vegetative parts (Coppice, Root suckers) - Artificial regeneration, Objectives - Nurseries - Types of nurseries, Quality seedling production techniques - Silvicultural practices for Eucalyptus spp, Casuarina equisetifolia, Tectona grandis, Ailanthus excelsa, Melia dubia, Leucaena leucocephala. Tending operations - Weeding, Cleaning, Thinning and pruning.

UNIT III- Forest Mensuration

Forest Mensuration - Objectives- Diameter measurements, instruments used in diameter measurement-Height measurement, instrumental methods of height measurement - Tree form, form factor, Volume estimation of standing and felled trees.

UNIT IV- Social forestry and Agroforestry

Social Forestry and its branches - Extension Forestry, Urban forestry - Agroforestry, definition-Importance- Agroforestry systems - Shifting Cultivation, Taungya, Alley cropping, Wind break, Shelter belt, Home garden - Tree and crop combination in Agroforestry - Tree crop interaction in Agroforestry - National Agroforestry Policy 2014.

UNIT V - Forest Utilization

Forest Utilization - Definition - Wood products - solid wood and composite wood.- Non Wood Forest Products - fibres , floss, bamboo, tan, dye, resin, oleoresin.

Practical

Identification of important farm grown trees - Identification of tree seeds and seedlings- Site selection for tree nursery and layout of nursery- Study of nursery techniques for Casuarina equisetifolia and Tectona grandis - Practicing clonal propagation in trees Practicing land preparation, stacking, pitting, planting techniques and after care operations in plantations- Height measurement in trees, diameter measurement in trees , Volume estimation in trees- Identification of wood and non- wood forest products - Visit to Agroforestry plantations

Lesson plan

Theory schedule

1. Introduction about forests, Definition of Forest and Forestry, branches in forestry
2. Role of Forest - Production function, Protection function and ameliorative functions of forests
3. Classification of Forest based on mode of regeneration, age, composition. ownership, object of management and growing stock
4. National Forest Policy 1988- Objectives and salient features
5. Forest regeneration - Types of regeneration - Natural regeneration through seeds and vegetative parts including coppice and root suckers
6. Artificial regeneration, Objectives - Nurseries - Types of nurseries, Quality seedling production techniques
7. Silvicultural practices for Eucalyptus spp, Casuarina equisetifolia, Tectona grandis, Ailanthus excelsa,
8. Silvicultural practices for Melia dubia, Leucaena leucocephala. Tending operations - Weeding, Cleaning, Thinning and pruning.
9. **Mid Semester Examination**
10. Forest Mensuration - Objectives- Diameter measurements, instruments used in diameter measurement
11. Height measurement, instrumental methods of height measurement - Tree form, form factor, Volume estimation of standing and felled trees.
12. Social Forestry and its branches - Extension Forestry and Urban forestry.
13. Agroforestry, definition- Importance- Agroforestry systems - Shifting Cultivation, Taungya, Alley cropping, Wind break, Shelter belt, Home garden
14. Tree and crop combination in Agroforestry- Tree crop interaction in Agroforestry –
15. National Agroforestry Policy 2014 , objectives and salient features
16. Forest Utilization - Definition - Wood products - solid wood and composite wood.
17. Forest Utilization - Non-Wood Forest Products - fibres, floss, bamboo, tan, dye, resin, oleoresin

Practical schedule:

1. Identification of important farm grown trees
2. Identification of tree seeds and seedlings
3. Site selection for tree nursery and layout of nursery
4. Study of nursery techniques for Casuarina equisetifolia
5. Study of nursery techniques for Tectona grandis
6. Practicing clonal propagation in trees Eucalyptus / Casuarina
7. Practicing land preparation, stacking, pitting
8. Planting techniques in plantation
9. After care operations in plantations
10. Height measurement in trees
11. Diameter measurement in trees
12. Volume estimation in standing and felled trees
13. Identification and study of wood products

14. Identification and study non- wood forest products
15. Visit to Agroforestry plantations
16. Visit to forest-based industry
17. **Final 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 and Development,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/S tart%20to%20read%20the%20Course.html.
5. http://ecoursesonline.iasri.res.in/course/view.php?id=157.

BIC 101 FUNDAMENTALS OF PLANT BIOCHEMISTRY (1+1)

Learning objectives

- To study about the carbohydrates, their occurrence, classification and significance
- To study about the lipids, their occurrence, classification and significance
- To study about the proteins and enzymes, their occurrence, classification and significance
- To understand the carbohydrate metabolism and respiration
- To understand the occurrence, classification and function of secondary metabolites

Theory

UNIT I Carbohydrates

Carbohydrates - occurrence and classification. Structure of monosaccharides, oligosaccharides and polysaccharides. Glycoconjugates - Glycoproteins and Lectin - structure and significance.

UNIT II-Lipids

Lipids - occurrence and classification. Storage lipids - fatty acids, triacylglycerol, essential fatty acids, waxes. Structural lipids - role of lipids in biological membrane - glycolipids and phospholipids - types and importance; Sterols - basic structure and their importance. Rancidity of oils.

UNIT III -Proteins and Enzymes

Amino acids - classification and structure. Essential amino acids. Classification of proteins based on functions and solubility. Structure of proteins: primary structure, secondary structure, tertiary structure and quaternary structure. Enzymes – Properties and classification and nomenclature. Mechanism of enzyme action. Factors affecting enzyme activity.

UNIT IV -Metabolism

Carbohydrate metabolism - breakdown of starch by amylases, glycolysis, TCA cycle and pentose phosphate pathway. Respiration - electron transport chain and oxidative phosphorylation.

UNIT V -Secondary metabolites

Secondary metabolites - occurrence, classification and functions of phenolics, terpenes and alkaloids.

Lecture schedule

1. Introduction to Biochemistry, Carbohydrates – occurrence and classification.
2. Structure of monosaccharides, oligosaccharides and polysaccharides.
3. Glycoproteins and lectin - structure and significance.
4. Lipids - occurrence and classification.
5. Storage lipids - Fatty acids and triacyl glycerol. Essential fatty acids, waxes.
6. Structural lipids - Glycolipids and phospholipids - types and importance. Sterols - basic structure and their importance. Rancidity of oils.
7. Amino acids - Classification and structure. Essential amino acids.
8. Classification of proteins based on function and solubility. Structure of protein - Primary, secondary, tertiary and quaternary structure.
9. **Mid Semester Examination**

10. Enzymes - Properties, classification and mechanism of enzyme action.
11. Factors affecting enzyme activity.
12. Carbohydrate metabolism - Glycolysis - Reactions and bioenergetics.
13. TCA cycle - Reactions and bioenergetics.
14. Pentose phosphate pathway – Reactions.
15. Respiration - electron transport chain and oxidative phosphorylation.
16. Secondary metabolites - occurrence, classification and functions of phenolics.
17. Occurrence, classification and functions of terpenes and alkaloids.

Practical Schedule

1. Qualitative analysis of carbohydrates
2. Estimation of starch
3. Estimation of amylose
4. Determination of reducing sugars
5. Qualitative analysis of amino acids
6. Sorenson's formal titration of amino acids
7. Estimation of amino acids by Ninhydrin method
8. Estimation of protein by Biuret method
9. Determination of free fatty acid of an oil
10. Determination of iodine number of an oil
11. Estimation of ascorbic acid by dye method
12. Assay of amylase
13. Estimation of total phenols
14. Extraction and estimation of lycopene and carotenoids
15. Separation of amino acids by paper chromatography
16. Separation of phenols by thin layer chromatography
17. **Final Practical Examination**

Course Outcome

CO1: Gain knowledge on carbohydrates, their occurrence, classification and significance
CO2: Gain knowledge on lipids, their occurrence, classification and significance
CO3: Gain knowledge on proteins and enzymes, their occurrence, classification and significance
CO4: Gain knowledge on proteins and enzymes, their occurrence, classification and significance
CO5: Gain knowledge on occurrence, classification and function of secondary metabolites

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. Berg JM, Tymoczko JL and Stryer L, (2007), Biochemistry, 7th Ed. Wiley Eastern Ltd. ISBN:0-7167-8724-5.

2. Thayumanavan, B, Krishnaveni, S and Parvathi, K, (2004), Biochemistry for Agricultural Sciences, Galgotia Publications Pvt Ltd., New Delhi. ISBN :81-7515-459-4.

e-References

1. Cox, MM and Nelson, DL. (2011), Principles of Biochemistry, Fourth (Indian edition) Macmillian, Worth Publishers. http://bcs.whfreeman.com/lehninger6e - Web links/ Tutorials/ Lecture companion Art

2. Harper's illustrated Biochemistry -https:// freemedebooks. files.wordpress.com /2014/01/ harpers-illustrated-biochemistry-28th-edition.pdf

3. J M Berg, J L Tymoczko and L Stryer, Biochemistry, Sixth Edition - http://www.irb.hr/users/ precali/ Znanost.o.Moru/ Biokemija/Literatura/Lubert%20Stryer%20-%20Biochemistry.pdf

4. Sadasivam, S and Manickam, A. (2009), Biochemical Methods, 3rd Edn, New Age International.

5. Wilson, K. and Walker, J.M. (2000), Principles and techniques of Practical Biochemistry, 5th Edn. – Cambridge University Press.

HOR 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, importance and 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.

Practical

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 of potting 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.
9. Practicing asexual propagation by different methods of Layering
10. Practicing asexual propagation by different methods of Budding
11. Practicing asexual propagation by different methods of Grafting.
12. Learning about the micro propagation techniques.
13. Practicing training and pruning of fruit trees.
14. Fertilizer application in different crops.
15. Visits to commercial nurseries/orchard.
16. Practical examination.

Course outcome

CO 1: The student will gain knowledge on branches of horticulture and the climatic requirements 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 orchard crops

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

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

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 Publishers and 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/

MAT 111 ELEMENTARY MATHEMATICS (1+1)

Theory

Unit – I-Algebra:

Permutation and Combination -meaning of nPr and nCr (simple problems). Matrices-Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order by adjoint method, Properties of determinants up to 3rd order and their evaluation.

Unit – II-Analytical Geometry:

Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to 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 straight lines, Angles between two straight lines, Parallel lines, Perpendicular lines.Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x1, y1) & (x2,y2).

Unit – III-Differential Calculus:

Definition of function, limit and continuity, Simple problems on limit, Simple problems on 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 (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Partial differentiation with first and second order - Maxima and Minima of the functions of the form y = f (x) and y = f(x1, x2) (Simple problems based on it).

Unit –IV-Integral Calculus:

Integration of simple functions, Integration of Product of two functions, Integration by substitution method, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it).

Unit-V-Mathematical Models:

Agricultural systems - Mathematical models - classification of mathematical models-Fitting of Linear, quadratic and exponential models to experimental data.

Practical

Simple problems in Permutation and Combination -meaning of nPr and nCr Problems in Algebra of matrices , Transpose and Inverse up to 3^{rd} order by adjoint method, evaluation of determinants up to 3^{rd} order**.** Problems in Straight lines using distance formula, section formula (internal and external division), Change of axes (only origin changed)- Equation of co-ordinate axes- Equation of lines parallel to axes. Problems in equation of a line in : Slope-intercept form, Slope-point form, two point forms,Intercept form, Normal form , General form, Point of intersection of two straight lines. Problems in Angles between two straight lines, Parallel lines, Perpendicular lines. Problems in Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x1, y1) & (x2,y2). Simple problems in limit and continuity. Problems in differentiation of x^n , e^x , sin x & cos x, derivatives of sum, difference, product and quotient of two functions. Simple problem based on differentiation of functions of functions and Logarithmic differentiation. Simpleproblems based on differentiation by substitution method. Problems in partial differentiation and Maxima and Minima of the functions of the form y=f (x)and

y=f(x1,x2). Problems in integration of simple functions and product of two functions- Definite Integral. Integration by substitution method-Problems in Area under simple well-known curves. Problems in fitting linear, quadratic and Exponential models to experimental data.

Theory Lecture Schedule:

1. Permutation and Combination -meaning of nPr and nCr (Simple Problems) .
2. Matrices- Definition of Matrices- Types of Matrices- Addition, Subtraction, Multiplication,Transpose
3. Determinants-Properties of determinants -up to 3^{rd} order evaluation and inverse up to 3^{rd}order by adjoint method.
4. Straight lines - Distance formula-section formula (internal and external division) - Change ofaxes (only origin changed) - Equation of co-ordinate axes- Equation of lines parallel to axes.
5. Forms of equation of Line-Slope-intercept form -Slope one point form - Two point form -Intercept form.
6. Normal form of equation of line- General form of equation of line- Point of intersection oftwo straight lines.
7. Angles between two straight lines- Parallel lines- Perpendicular lines- Angle of bisectorsbetween two lines.
8. Circle-Equation of circle whose centre and radius is known- General equation of a circle- Equation of circle passing through three given points- Equation of circle whose diameters is line joining two points (x1, y1) & (x2,y2).
9. **Mid Semester Examination**
10. Differential Calculus - Definition of function, limit and continuity- Simple problems on limitand continuity.
11. Differentiation of x^n , e^x , sin x & cos x from first principle-Derivatives of sum, difference, product and quotient of two functions- Differentiation using functions of function rule (Simple problem based on it)
12. Logarithmic differentiation (Simple problem based on it)- Differentiation by substitution method and simple problems based on it- Differentiation of Inverse Trigonometric functions
13. Maxima and Minima of the functions of the form y=f (x) and y=f(x1,x2) (Simple problemsbased on it).
14. Integral Calculus - Integration of simple functions and Product of two functions- DefiniteIntegral (simple problems based on it)
15. Integration by substitution method- Area under simple well-known curves (simple problemsbased on it).
16. Agricultural systems - Mathematical models - classification of mathematical models- Linearmodel.
17. Quadratic and Exponential models- applications of mathematical models in agriculture.

Practical schedule

1. Simple problems in Permutation and Combination.
2. Problems in Addition, Subtraction, Multiplication and Transpose of a matrix
3. Problems in determinants and Inverse up to 3rd order by adjoint method.
4. Problems in Straight lines using distance formula, section formula (internal and external division), Change of axes (only origin changed)- Equation of co-ordinate axes- Equation of lines parallel to axes.
5. Problems in Slope-intercept form of equation of line, Slope-point form of equation of line,two point forms of equation of line, Intercept form of equation of line.
6. Problems in Normal form of equation of line, General form of equation of line, Point of intersection of two straight lines.
7. Problems in Angles between two straight lines, Parallel lines, Perpendicular lines, Angle ofbisectors between two lines.
8. Problems in Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x1, y1) & (x2,y2).
9. Simple problems in limit and continuity.
10. Problems in differentiation of x^n , e^x , sin x & cos x, derivatives of sum, difference, product ,quotient of two functions and differentiation of functions of functions.
11. Simple problem based on Logarithmic differentiation and differentiation by substitutionmethod.
12. Problems in Maxima and Minima of the functions of the form y=f (x) and y=f(x1,x2)
13. Problems in integration of simple functions and product of two functions using integration byparts-Definite Integral.
14. Integration by substitution method-Problems in Area under simple well-known curves
15. Problems in fitting linear models to experimental data .
16. Problems in fitting Quadratic and Exponential models to experimental data.
17. **Final Practical Examination.**

References:

1. Mehta, B. C. and G. M. K. Madnani, 2014, Mathematics for Economists, Sultan Chand & Sons, New Delhi.
2. Kailasam.C, Pangayar Selvi. R and Vasanthi. R, 2010 , Applied Mathematics, Agrobios (India), Jodhpur
3. James Stewart and Barhara Frank, Calculus, 2008, International Thomson Publishers, Singapore
4. Duraipandian, 2007, Calculus and Analytical Geometry, Emerald Publishers, Chennai.
5. Ranganathan.C.R. 2006, A First Course in Mathematical Models of Population Growth (with MATLAB programs), Associated publishing company, New Delhi
6. Manickavasagam Pillai, T. K and Natarajan, T. 2004. Calculus, Viswanathan Publications,Madras

GPB 111 INTRODUCTION TO AGRICULTURAL BOTANY (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 of Poaceae: 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, Brassicaceae andMalvaceae

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 of the 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 of crops.
3. General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, 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 the following 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 and Subabul, 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.

EXT - 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 types and 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 behaviour and 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-Learning Process

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
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. Structure of rural society – patterns of rural settlement
6. Social institutions,
7. Social organizations
8. Ecological entities - region, community, neighbourhood and family
9. Social stratification – concept, functions, types, differences between class and caste system
10. Social values – definition, values and norms, characteristics of values and its functions
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. Socialpsychology – definitions, importance in extension
21. Basic principles of human behaviour
22. Sensation, attention, perception – meaning, characteristics
23. Cognitive, affective, psychomotor domains
24. Intelligence – concept, types, measurement, factors affecting intelligence
25. Personality – concept, types
26. Personality measurement- factors influencing personality

27. Teaching–learning Process
28. Teaching – definition, meaning, principles of teaching
29. 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 of thoughts.

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

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

Learning objectives

- To impart basic language skills such as listening, speaking, reading and writing in order tocommunicate 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 oftenconfused 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 BehaviouralInterview--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, exercises Practice 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 andexercises 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 Comparison andtypes 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 correspondence Personal 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

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

TAM 111* தமிழ் இலக்கியங்களில் வேளாண் மையுைை அறிவியல் தமிழ் பயன் பாடுைை **(1+0)**

bjhy;fhg;gpak; fhl;Lk; Kjw;bghUs;/ fUg;bghUs; - r';f இyf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ik mwptpay; - gs;S இyf;fpa';fs;/ VbuGgJ/ இyf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; kidapay; - NHypay; ntshz;ikg; gHbkhHpfs; - இyf;fpak; fhl;Lk; thH;tpay; bewpKiwfs; - இf;fhy இyf;fpa';fspy; ntshz;ikr; rpe;jidfs; - gpiHapd;wp vGJk; Kiwfs; - இyf;fpaj;jpy; bkd;jpwd;fs; - mwptpay; jkpH; tsh;r;rp epiyfs; fiyr;brhy;yhf;fk; - bkhHp bgah;g;ghsh; - Ml;rpj; jkpH; - cHth;fSf;fhd mwptpg;g[fis btspapLjy; - fl;Liur; RUf;fk; vGJjy; - fzpdp cyfpy; jkpH;

bra;Kiwg; gapw;rpfs;

1. bjhy;fhg;gpak; fhl;Lk; Kjw;bghUs;/ fUg;bghUs; tHp ntshz; kug[fis mwpjy;
2. r';f ,yf;fpaj;jpy; ntshz; bjhHpy; El;g';fs; - (vl;Lj;bjhif/ gj;Jg;ghl;L)
3. gjpbdz; fPH;f;fzf;F E}y;fspy; ntshz;ik mwptpay;
4. gs;S ,yf;fpa';fs;/ VbuGgJ – cHth; thH;tpay; bewpKiwfSk; ntshz;ikj; bjhHpy; El;g';fSk;
5. ,yf;fpaj;jpy; ntshz; bghwpapay; - njhl;ltpay; - tdtpay; - kidapay; - NHypay;
6. ntshz;ikg; gHbkhHpfs; - cHt[tpij mwptpay; - ehw;W eLjy; - vU ,Ljy; - ePh;g;ghrdk; - fisnkyhz;ik – gaph;ghJfhg;g[- mWtil – cHth; rKjhak;
7. ,yf;fpak; fhl;Lk; thH;tpay; bewpKiwfs;
8. ,f;fhy ,yf;fpa';fspy; ntshz;ikr; rpe;jidfs; - ghujp/ ghujpjhrd; gilg;g[fs; - g[Jf;ftpij – rpWfij – g[jpdk;
9. ,ilepiyg; gUtj;njh;t[
10. gpiHapd;wp vGJk; Kiwfs; - vGj;Jg; gpiHfs; - brhw;gpiHfs; - brhw; gphpg;g[g;gpiH – thf;fpag;gpiH – bka;g;g[j; jpUj;jk;
11. ,yf;fpaj;jpy; bkd;jpwd;fs; - jiyikg;gz;g[- fhy nkyhz;ik
12. MSikg;gz;g[nkk;ghL – kdpj cwt[j;jpwd;fs; tsh;j;jy;
13. mwptpay; jkpH; tsh;r;rp epiyfs;/ ntshz; E}y;fs;/ ntshz; ,jH;fs;
14. fiyr;brhy;yhf;fk; - ntshz; fiyr; brhw;fis cUthf;Fk; Kiw – jug;gLj;Jjy; - ,yf;fpa ntshz;fiyr;brhw;fs;/ tl;lhu ntshz;ik tHf;Fr; brhw;fs; - mfuhjpapay;
15. bkhHp bgah;g;g[- Kf;fpa tpjpfs; - goepiyfs; - bkhHp bgah;ghshpd;

,d;wpaikahg; gz;g[fs; -ntshz; bra;jpfis bkhHp bgah;j;jy;

16. Ml;rpj; jkpH; - murhizfs; mYtyf; foj';fs; - cHth;fSf;fhd mwptpg;g[f;fis btspapLjy; - fl;Liur;RUf;fk; vGJjy;

17. fzpdp cyfpy; jkpH; - xU';F FwpaPL gapw;Wtpj;jy; - tiyg; g{f;fs; - tpf;fpgPoah – ntshz;bra;jpfisg; gjpntw;wk; bra;jy; - ntshz; bra;jpfis ,izajs tHp mwpjy;

நூல் குறிப்புகள் :

- fe;jrhkp. ,y. br. ntshz;ik gHbkhHpfs;/ fiyr;bry;tk; gjpg;gfk;;/ nfhak;g[j;J}h; 1983.
- FHe;ijrhkp.th.br. mwptpay; jkpH;/ ghujp gjpg;gfk;/ brd;id
- kPdhl;rp Re;juk;. kh. kw;Wk; V.,y.tprayl;Rkp jfty; bjhlh;gpy; jkpH; bkhHpg;gad;ghL/nf.Mh;.v.Mg;brl; gphpz;lh;/ nfhit – 2002
- kzpnkfiy.k. jkpH; bkhHpj; jlj;jpy; ntshz; mwptpaypd; RtLfs;/ njtp gjpg;gfk;/jpUr;rpuhg;gs;sp/ 2002
- ,yf;fpaKk; ntshz;ika[k;/ midj;jpe;jpa mwptpay; jkpH;f; fHfk;/ j";rht{h;;/ 2006
- jkpHhpd; kug[r;bry;t';fs;/ cyfj; jkpH ஆuha;r;rp epWtdk;/ brd;id
- ntshz;fiyr;brhy; ngufuhjp/ jkpH;ehL ntshz;ikg; gy;fiyf;fHfk;/ nfhak;g[j;J}h;/ 2008.
- lhf;lh; ,uhjh bry;yg;gd;/ fiyr;brhy;yhf;fk;/ jkpH;g; gy;fiyf;fHfk;/ j";rht{h;

NSS 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 five regular one day camp ina 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 all the 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 byNSS 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 harmony and national integration** Indian history and culture, role of youth in nation building, conflict resolution and peacebuilding

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 IIImportance and role of youth leadership

Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youthleadership

Life competencies

Definition and importance of life competencies, problem-solving and decision-making, interpersonal communication

Youth development programmes

Development of youth programmes and policy at the national level, state level and voluntarysector; 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 healthprogrammes 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 itsimpacts, yoga as a tool for healthy lifestyle, preventive and curative method

SEMESTER III

Course Title: National Service Scheme IIIVocational 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

conditions andopportunities. 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 developmentand 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 of financial 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 IVYouth and crime

Sociological and psychological factors influencing youth crime, cyber crime, pear mentoring inpreventing 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

NCC 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. Nationalintegration.

Semester II: National Cadet Corps

11. Values and ethics, perception, communication, motivation, decision making, discipline and duties 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 development projects.
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 falling out.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 and viceversa.
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 andalteration 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 technical terms.

Semester IV: National Cadet Corps

1. The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
2. Prismatic compass and its use. Setting a map, finding north and own position. Map to groundand ground to map.
3. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
4. Field defenses obstacles, mines and mine lying. Bridging, waterman ship
5. Field water supplies, tracks and their construction.
6. Nuclear, Chemical and Biological Warfare (NCBW)
7. Judging distance. Description of ground and indication of landmarks.
8. Recognition and description of target. Observation and concealment. Field signals. Sectionformations.
9. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
10. Types of communication, media, latest trends and developments.

PEY 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 gamesituation 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 gamesituation 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

1. Teaching of different asanas – demonstration practice and correction.
2. Teaching of different asanas – demonstration practice and correction.
3. Teaching of different asanas – demonstration practice and correction.
4. Teaching of different asanas – demonstration practice and correction.
5. Teaching of weight training – demonstration practice and correction.
6. Teaching of circuit training – demonstration practice and correction.
7. Teaching of calisthenics – demonstration practice and correction
8. Mid Semester
9. Teaching of skills of Hockey – demonstration practice of the skills and correction.
10. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.
11. Teaching of different track events – demonstration practice of the skills and correction.
12. Teaching of different track events – demonstration practice of the skills and correction.
13. Teaching of different track events – demonstration practice of the skills and correction with
14. Competition among them.
15. Teaching of different field events – demonstration practice of the skills and correction.
16. Teaching of different field events – demonstration practice of the skills and correction.
17. Teaching of different field events – demonstration practice of the skills and correction withcompetition among them.

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

II SEMESTER

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

Learning objectives

- To know the basic concepts of agricultural meteorology and recording various weatherelements in observatory.
- To understand about solar radiation, temperature and relative humidity on crop production
- 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 ofweather forecasting.

Theory

Unit -I: Introduction to Meteorology and Agrometeorology

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

IV: Atmospheric humidity, precipitation and clouds

Atmospheric humidity-effect of humidity on crops- concept of saturation, vapour pressure andprocess of condensation, evaporation, evapotranspiration, PET, different forms of precipitation and 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, wind direction and velocity, solar radiation, sunshine hours, evaporation, evapotranspiration, automatic weather station, preparation of synoptic charts and crop weather calendars, mappingof agro climatic zones.

Lesson plan

Theory Schedule

1. Introduction to meteorology – branches- definitions of meteorology, climatology and agricultural 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, anticyclone, effect of wind on crops- 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 and condensation – 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 forcrop 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 NMV University Agrometeorology observatory (I O T b a s e d) 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 and variation 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 and how 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
CO4: To create awareness on cloud types, precipitation, drought, flood and evapotranspiration.
CO 5: To formulate cropping pattern for different Agroclimatic zones of India and TamilNadu, 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. Agro tech Publishing Academy. Udaipur
2. Laxmi Lal. 2021. Introduction to Agrometeorology. Agro tech 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. https://www.rvskvv.net/images/II-Year-II-Sem_Agro Meteorology_a_20.04.2020.pdf
2. https://agrifair.in/wp-content/uploads/2021/01/Introductory-Agrometeorology-and-Climate-Change.pdf
3. https://www.rvskvv.net/images/II-Year-II-Sem_Agro-Meteorology_a_20.04.2020.pdf.

AGM 101 AGRICULTURAL MICROBIOLOGY (2+1)

Learning Objectives:

- To enable better understanding of students about the microscopic worldaroundthem
- To acquaint students with the basic laboratory techniques and tools ofmicrobiology
- To highlighten the role of soil microorganisms in soil fertility and plant growthpromotion
- To develop experimental skills in soil microbiology which includes isolation of beneficial microorganisms from soil and plant and their mass production
- To understand biogeochemical cycles through the microbial transformation of nutrients 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 - Bacterial size, 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 theactivities 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 and Phosphorous cycle; 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 theirimportance, R:S Ratio
25. Phyllosphere microorganisms
26. Soil microorganisms and their interactions
27. Positive and negative interaction.
28. Plant growth promoting Rhizobacteria and PPFM
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 insoil 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 Hillpublishers, New York
2. Rangaswami G Bhagyaraj D J (2nd ed) 2001, Agricultural Microbiology: PrenticeHall of India Pvt Ltd., New Delhi
3. Prabhakaram. G. 2004, Introduction to Soil & Agricultural Microbiology: Himalayapublication house, Mumbai
4. Sullia, S.B, and Shantaram, 1998, General Microbiology: Oxford and IBH PublisingCompany, 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=
4. 7krg9nCVT2Aqe8ze5U9Mq58bOrnCz2_yXe_JTRlqB4w-1649310409-0-gaNycGzNCCU
5. https://www.rapidmicrobiology.com/

GPB 101 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 Mutation theory. 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 additive epistasis (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-point test cross. Double cross over, interference and coincidence; genetic map. Chromosomal aberration: Variation in chromosome structure – deletion, duplication, inversion and translocation – 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 balance theory of Bridges, Sex linked inheritance – criss cross inheritance – reciprocal difference; holandric genes; sex influenced and sex-limited inheritance. Cytoplasmic inheritance and maternal effects – features of cytoplasmic inheritance, chloroplast, mitochondrial - plastid colour in *Mirabilis Jalapa* - iojap gene of maize, cytoplasmic male sterility in rice, kappa particles 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

Study of microscope- Study of cell structure- Study of cell organelles- Experiments on monohybrid- Experiments on Dihybrid - Experiments on trihybrid- Test cross, backcross, experiments on gene interactions (monohybrid)- Experiments on Study of cell gene interactions (Di hybrid)- Experiments on epistatic gene interactions- Experiments on epistatic gene interactions- Experiments on probability- Experiments on chi-square test – Gene interactions- Determination of linkage and cross over analysis through two point test cross data- Determination of linkage and cross over analysis through three point test cross data- Sex linked inheritance in *Drosophilla*- Study of models on DNA and RNA structure

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 of life.
CO 2: Importance of studying Linkage and recombination mapping will be well understood by the students.

CO 3: Students will able to figure out the Fine structure of gene and gene mapping techniques.
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 better idea 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/

SOL 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 organic matter, 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

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

nitrophosphate and N, P, K complexes

12. Mixed fertilizers-definition, preparation and compatibility
13. Preparation and characteristics and compatibility - Specialty/ Customized fertilizers, Water soluble 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 nutrient mobility 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 of importance 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 enhancement Techniques.
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 soils
CO2: 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 development
CO5: 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 PlantNutrition, 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.

ENT 101 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 and reproductive systems in insects. Types of reproduction and mating. Functions of exocrine and endocrine glands. Sensory organs and their functions.

Unit IV: Taxonomy of Apterygota and Exopterygota

Insect systematics; distinguishing characters of agriculturally important orders and families of Hexapoda. Apterygota (Thysanura, Diplura, Protura and Collembola); Exopterygota (Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera, Mallophaga, Thysanoptera and Siphunculata).

Unit V: Taxonomy of Endopterygota

Distinguishing characters of agriculturally important families of Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Neuroptera and Strepsiptera.

Practical

Observations on external features of grasshopper / cockroach, Methods of insect collection, preservation – Preparation of Riker mount. Types of insect head, antenna, and mouth parts – Structure of thorax. Types of insect legs, wings and their modifications – wing coupling. Structure of abdomen, and its modifications. Metamorphosis in insects – immature stages in insects. Study of digestive and reproductive systems of grasshopper / coackroach – Observing the characters of agriculturally important orders and families.

Assignment: Each student has to submit 50 insects covering at least ten orders

Theory lecture schedule

1. History of Entomology in India; Position of insects in the animal kingdom - relationship with other members of Arthropoda
2. Structural, morphological and physiological factors responsible for dominance
3. Insect body wall - its structure and function; cuticular appendages
4. Moulting process in insects
5. Structure of insect head and its appendages
6. Structure of insect thorax and its appendages
7. Structure of insect abdomen and its appendages
8. Structure of alimentary canal and its modifications; Digestive enzymes, digestion and absorption of nutrients
9. Excretory system - Malpighian tubules - accessory excretory organs and physiology of excretion
10. Respiratory system – types - structure of trachea - tracheoles - types of spiracles - respiration in aquatic and endoparasitic insects
11. Circulatory system - haemocoel and dorsal vessel - circulation of blood -composition of haemolymph - haemocytes and their functions
12. Nervous system - Structure of neuron – types of nervous systems
13. Axonic and synaptic transmissions of nerve impulses
14. Male and female reproductive systems in insects – structure and modifications - Spermatogenesis and Oogenesis
15. Oviparous, viviparous, paedogenesis, polyembryony, ovoviporous and parthenogenesis
16. Embryogenesis; Types of metamorphosis – Immature stages of insects
17. **Mid-semester examination**
18. Structure of sense organs - types of sensilla – photoreceptors, chemoreceptors and mechanoreceptors
19. Exocrine and endocrine glands and their function - effect on metamorphosis and reproduction
20. Tropism and Biocommunication in insects — Sound and light production
21. Systematics - principles and procedures of classification and nomenclature of insects
22. Distinguishing characters of insect orders — Apterygota (Thysanura, Diplura, Protura and Collembola), Exopterygota — (Ephemeroptera, Odonata and Phasmida)
23. Orthoptera (Ensifera - Tettigonidae, Gryllidae and Gryllotalpidae; Caelifera - Acrididae and Tetrigidae), Dictyoptera, Dermaptera and Embioptera
24. Isoptera — social life in termites
25. Thysanoptera, Pscoptera, Mallophaga and Siphunculata.

26. Hemiptera – Homoptera (Delphacidae, Flatidae, Cercopidae, Cicadidae, Membracidae, Cicadellidae, Psyllidae, Aleyrodidae, Aphididae, Margarodidae, Kerridae, Pseudococcidae, Coccidae, Asterolecaniidae and Diaspididae)
27. Hemiptera - Heteroptera (Tingidae, Reduviidae, Cimicidae, Anthocoridae, Miridae, Lygaeidae, Pyrrhocoridae, Coreidae, Scutellaridae, Pentatomidae, Veliidae, Gerridae, Naucoridae, Belastomatidae, Nepidae, Notonectidae and Corixidae)
28. Endopterygota — Classification of Lepidoptera – suborders; butterfly families (Nymphalidae, Lycaenidae, Pieridae, Papilionidae, Satyriidae and Hesperiidae)
29. Moth families (Psychidae, Gelechiidae, Metarbellidae, Cochlidiidae, Pyralidae, Crambidae, Pterophoridae, Geometridae, Bombycidae, Saturniidae, Sphingidae, Arctiidae, Noctuidae and Lymantriidae)
30. Classification of Coleoptera – suborders; Adephaga (Carabidae, Cicindellidae, Dytiscidae, Gyrinidae)
31. Polyphaga (Hydrophilidae, Staphylinidae, Passalidae, Lucanidae, Scarabaeidae, Dynastidae, Melolonthidae, Cetonidae, Buprestidae, Elateridae, Lampyriidae, Cantharidae, Dermestidae, Anobiidae, Bostrychidae, Coccinellidae, Tenebrionidae, Meloidae, Cerambycidae, Bruchidae, Chrysomelidae, Apionidae and Curculionidae)
32. Diptera – Suborders; Nematocera (Tipulidae, Psychodidae, Culicidae, Bibionidae, and Cecidomyiidae), Brachycera (Tabanidae, Asilidae and Bombylidae,), Cyclorrapha (Syrphidae, Drosophillidae, Muscidae, Calliphoridae, Tachinidae, Hippoboscidae, Micropezidae, Agromyzidae, Chloropidae and Tephritidae)
33. Hymenoptera – Suborders; Symphyta (Tenthredinidae) Apocrita (Ichneumonidae, Braconidae, Evaniidae, Agaonidae, Chalcididae, Encyrtidae, Eulophidae, Trichogrammatidae, Bethylidae, Chrysididae, Scoliidae, Mutillidae, Formicidae, Vespidae, Sphecidae, Megachilidae, Anthophoridae, Xylocopidae and Apidae)
34. Neuroptera (Mantispidae, Chrysopidae, Myrmeleontidae and Ascalaphidae); Siphonaptera and Strepsiptera

Practical Schedule

1. Observations on segmentation and external features of grasshopper/ cockroach/blister beetle
2. Practicing the methods of collection, killing, pinning, labelling, display and preservation of insects 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 of female mosquito, honeybee, thrips, antlion grub, house fly and butterfly
5. Observations on the modifications in legs and wings (wing venation, regions, angles and wing coupling)
6. Studies on the types of metamorphosis. Observations on immature stages of insects – Eggs, larvae and pupae and their types
7. Demonstration of digestive system (grasshopper/cockroach)
8. Demonstration of male and female reproductive systems (grasshopper /cockroach)

9. Characters of Apterygota – Collembola and Thysanura; Exopterygota - Odonata, Ephemeroptera and Phasmida
10. Characters of Exopterygota: Dictyoptera, Dermaptera, Embioptera, Orthoptera, Mallophaga and Siphunculata
11. Characters of Exopterygota: Isoptera and Hemiptera
12. Characters of Exopterygota: Thysanoptera and characters of Endopterygota: Diptera
13. Characters of Endopterygota: Hymenoptera
14. Characters of Endopterygota: Coleoptera
15. Observation on distinguishing characters of Lepidoptera
16. Characters of Endopterygota: Neuroptera and Siphonaptera
17. **Final practical examination**

Course Outcome

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

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

CO3: Describe anatomy and physiology of various systems in insects

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

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. Chapman, R.F. 1998. *The Insects: Structure and Function*. Fourth Edition. Cambridge University Press. 770p. {ISBN 0 521 78732 7}
2. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*. Vol. I and II. Chapman and Hall Publication, London. 1354p. {ISBN 0412 15220 7}
3. Snodgrass, R.E. 1994. *Principles of Insect Morphology.* CBS publishers and distributors, New Delhi. 667p.
4. Srivastava, P. D. and R. P. Singh. 1997. An Introduction to Entomology. Concept Publishing Company, New Delhi.

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

HOR 102 PRODUCTION TECHNOLOGY FOR FRUIT AND PLANTATION CROPS (1+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: Production status of fruit and plantation crops

Importance and scope of fruit and plantation crop industry in India – nutritional value of fruit crops - classification of fruit crops – area, production, productivity and export potential of fruit and plantation crops.

UNIT II:

Crop production techniques in tropical fruit crops

Climate and soil requirements – varieties – propagation and use of rootstocks- planting density and systems of planting - High density and ultra-high density planting - cropping systems - after care - training and pruning - water, nutrient and weed management – fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- value addition. **Fruit crops**: mango, banana, papaya, guava, sapota

UNIT III:

Crop production techniques in subtropical fruit crops

Climate and soil requirements – varieties – propagation and use of rootstocks- planting density and systems of planting - High density and ultra-high density planting - cropping systems - after care - training and pruning - water, nutrient and weed management – fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest and value addition. **Fruit crops:** citrus, grape, litchi, pineapple, pomegranate, jackfruit and minor fruits

UNIT IV:

Crop production techniques temperate fruit crops

Climate and soil requirements – varieties – propagation and use of rootstocks - planting density and systems of planting -High density and ultra-high density planting -cropping systems - after care - training and pruning - water, nutrient and weed management – fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest and value addition. **Fruit crops:** apple, pear, peach, strawberry, nut crops.

UNIT V

Crop production techniques in palms and plantation crops

Climate and soil requirements - varieties - propagation - nursery management - planting and - planting systems - cropping systems - after care - water, nutrient and weed management - intercropping - multitier cropping system - mulching - special horticultural

practices - maturity indices, harvest and yield - pests and diseases - processing - value addition

Palms: Coconut, Arecanut, Oil palm and Palmyrah

Climate and soil requirements - varieties- propagation - nursery management - planting and planting systems - cropping systems- after care- training and pruning - water, nutrient and weed management - shade management - intercropping - mulching - cover cropping - special horticultural practices - maturity indices, harvest and yield - pests and diseases - processing - value addition.

Plantation crops: Tea, Coffee, Cocoa, Cashew, Rubber

Practical

Propagation methods for fruit crops - description and identification of varieties - preparation of plant bio regulators & their uses – nutrient deficiency and disorders of fruit crops - fertilizers- application - pests and diseases- micro propagation in fruit crops- Visit to commercial orchard.

Fruit Crops: Mango, banana, papaya, guava, sapota, grapes, citrus (Mandarin and acid lime), pomegranate and jackfruit

Propagation methods for plantation crops - description and identification of plantation crops - preparation of plant bio regulators & their uses - nutritional disorders of plantation crops - fertilizers-application - pests and diseases- cost economics of plantation crops. Visit to plantations and plantation industries.

Palms and plantation Crops: Coconut, Arecanut, Cashew, Tea, Coffee, Rubber and Cocoa

Theory lecture schedule:

1. Importance and scope of fruit and plantation crop industry in India – nutritional value of fruit crops
2. Classification of fruit crops – area, production, productivity and export potential of fruit and plantation crops
3. Production Technology of Mango
4. Production Technology of Banana
5. Production Technology of Papaya, Guava and sapota
6. Production Technology of Citrus and Sweet orange
7. Production Technology of Mandarin and Acid Lime
8. Production Technology of Grapes
9. **Mid semester examination**
10. Production Technology of pineapple and litchi
11. Production Technology of Pomegranate, jackfruit and minor fruits
12. Production Technology of Apple and pear
13. Production Technology of Peach and strawberry, nut crops
14. Production Technology of Coconut, Arecanut and Cocoa
15. Production Technology of Rubber and Cashew.
16. Production Technology of Tea and coffee
17. Production Technology of Oil palm and Palmyrah

Practical schedule

1. Propagation techniques, selection of planting material, varieties, important cultural practices for Mango.
2. Propagation techniques, selection of planting material, varieties, important cultural practices for Banana
3. Propagation techniques, selection of planting material, varieties, important cultural practices for Papaya
4. Propagation techniques, selection of planting material, varieties, important cultural practices for Guava
5. Propagation techniques, selection of planting material, varieties, important cultural practices for Sapota
6. Propagation techniques, selection of planting material, varieties, important cultural practices for Grapes
7. Propagation techniques, selection of planting material, varieties, important cultural practices for Citrus (Mandarin and acid lime)
8. Propagation techniques, selection of planting material, varieties, important cultural practices for Pomegranate
9. Propagation techniques, selection of planting material, varieties, important cultural practices for Jackfruit
11. Preparation and application of PGR's for propagation.
12. Micro propagation, protocol for mass multiplication and hardening of fruit crops.
13. Identification and description of varieties - mother palm and seed nut selection - nursery
14. practices- seedling selection – fertilizers - application - nutritional disorders - pests and diseases of Coconut
15. Identification and description of varieties - mother palm and seed nut selection- nursery practices-fertilizers - application - nutritional disorders - pests and diseases of Arecanut and cocoa
16. Identification and description of varieties - nursery practices - training and pruning - pests and diseases – processing of Tea and coffee
17. Identification and description of varieties, clones - bud wood nursery practices - propagation techniques - top working – preparation of plant bio regulators and its uses- pests and diseases - processing of Rubber and cashew

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 Fruit crops.

CO 3: The students can demonstrate important production techniques and diagnose problems in 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

Reference

1. Kumar, N. 2014. Introduction to Horticulture. Oxford & IBH Publishing co. Pvt. Ltd.
2. Chadha, K.L and Pareek, O.P. 1996. (Eds.). Advances in Horticulture. Vols. IIIV. Malhotra Publ. House
3. Kumar, N. 2014. Introduction to Spices, Plantation, Medicinal and Aromatic crops, IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Alice Kurian and Peter, K.V. 2007. Horticulture science series Vol. 08, New India Publishing Agency, New Delhi.
5. Veeeraragavathatham, D and et al.,2004. Scientific fruit culture, Sun Associates, Coimbatore.

E - references

1. http://www.jhortscib.com
2. http://journal.ashspublications.org
3. http://www.actahort.org/
4. http://www.aphorticulture.com/crops.htm
5. http://cpcri.nic.in/

FSN 101 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 preservationtechnologies.
- To have a knowledge on the fermentation technologies of producing value-added foods bymicrobes and their spoilage.
- To impart knowledge on nutritive value on foods, spoilage and develop skills and techniqueson pasteurization and preservation methods.
- To learn advanced techniques on food production, processing, packing and quality control.

Theory

Unit - I: Principles of Food Science and Nutrition

Food Science - definition – classification of foods – functional and nutritional classification. Food groups and food pyramid. Methods of cooking - moist, dry and microwave - principles, merits and demerits. Importance and scope of nutrition – relation

of nutrition to health.

Unit -II: Carbohydrate, Protein and Fat

Carbohydrate – classification, functions, digestion and absorption, sources and Recommended Dietary allowance (RDA). Energy value of foods – determination. Protein- classification, functions digestion and absorption, sources and requirements. Protein quality of foods – supplementary value of protein. Fat - classification functions, digestion and absorption, sources and requirements. Rancidity – types of rancidity and prevention. Deficiency states of protein, carbohydrate and fat nutrition – signs and symptoms.

Unit III: Vitamin and Mineral Nutrition

Fat Soluble vitamins – A, D, E and K- functions, sources, requirements and deficiency. Water soluble vitamins – thiamine, riboflavin, niacin, pyridoxine, folic acid, cyanocobalamin, biotin, pantothenic acid ascorbic acid – functions, sources, deficiency and requirements. Minerals - calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine and chlorine – functions, sources, deficiency and requirements. Importance of water – maintenance of electrolyte balance. Dietary fiber - importance, health benefits, sources and requirements.

Unit IV: Food Preservation and Processing

Introduction – preservation by sugar - processing of jam, squash, jelly, marmalade and beverages. Preservation by using salt, chemicals, dehydration technology, canning technology, preservation by low temperature and irradiation techniques. Processing of puffed, flaked and extruded products. Quality control of raw and processed products.

Unit V: Food Quality and Safety

Food packaging materials – requirements – methods – nutrition labeling. Food adulterants and their detection methods. Food laws and regulations and quality control standards - FSSAI, ISO, EU standards, FDA, HACCP and Codex Alimentarius Commission.

Practical

Determination of energy value of Foods, cooking quality tests – cereals and pulses. Estimation of moisture, protein and fat. Processing of jam, jelly, and squash, ready to serve beverages (RTS). Preparation of flaked, puffed and extruded products. Visit to food industries and quality control laboratory.

Theory Lecture Schedule:

1. Food Science – definition, scope and classification, food pyramid.
2. Methods, merits and demerits of moist heat, dry heat and microwave cooking of foods.
3. Importance and scope of nutrition and the relation of nutrition to health.
4. Carbohydrate – classification, functions, digestion and absorption, deficiency symptoms, sources andrequirements.
5. Protein – classification, functions, digestion and absorption, deficiency symptoms, sources andrequirements. Protein quality – supplementary value of protein.
6. Fat - classification, functions, digestion and absorption, deficiency symptoms, sources andrequirements. Rancidity – types. Determination of energy value of foods.
7. Fat soluble vitamins – A, D, E and K – functions, deficiency symptoms, sources and requirements.
8. Water soluble vitamins - thiamine, riboflavin, niacin, pyridoxine, folic acid,

cyanacobalamin, biotin, pantothenic acid, ascorbic acid – functions, deficiency symptoms, sources and requirements.

9. **Mid Semester Examination**
10. Minerals – calcium, iron, phosphorus, iodine, magnesium, zinc, sodium, potassium, fluorine andchlorine – functions, sources, requirements and deficiency diseases.
11. Importance of water and maintenance of electrolyte balance. Health benefits of fibre.
12. Preservation of food by low and high temperature and food irradiation.
13. Processing of puffed, flaked and extruded products
14. Preservation by using sugar (jam, jelly, squash and marmalade), preservation by using salt (briningand pickling) and use of preservatives in food preservation.
15. Food packaging – importance, types of packaging materials and nutrition labeling.
16. Common food adulterants and their detection.
17. Food laws and regulations and quality control standards - FSSAI, ISO, EU standards, FDA, HACCPand Codex Alimentarius Commission.

Practical Schedule:

1. Cooking tests for cereals and pulses
2. Determination of energy value of food
3. Estimation of moisture
4. Estimation of protein
5. Estimation of fat
6. Estimation of ascorbic acid
7. Estimation of iron
8. Estimation of crude fibre
9. Processing of jam and jelly
10. Processing of squash and RTS
11. Puffing of pulses
12. Extrusion of cereals and millets
13. Canning of fruits and vegetables
14. Processing of dehydrated fruits and vegetables
15. Identification of common food adulterants
16. Visit to food processing unit and quality control lab
17. **Final 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-added foodsby microbes and their spoilage.

CO 4 - The students would expose to the principles involving the food preservation.

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

References :

1. Srilakshmi, B. 2005. Food Science. New Age International (P) Ltd., Publishers, New Delhi.
2. Srivastava, R.P., and Sanjeevkumar. S. 2013. Fruit and Vegetable preservation. International BookDistributing Co. Lucknow.
3. Srilakshmi .B. 2015. Nutrition Science. New Age International Pvt. Ltd. New Delhi.
4. Vijaya khader. 2001. Text book of Food Science and Technoology. Directorate of informationand publications of agriculture, ICAR, New Delhi.
5. Adams, M. R. 2008. Food Microbiology (3rd edition), Panima Publishing Corporation, NewDelhi

E- References :

1. www.cellinteractive.com
2. www.nutrition.org.uk
3. www.fnic.nal.usda.gov
4. www.myfooddiary.com

AEC 101 FUNDAMENTALS 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, incomeelasticity 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, and 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 of money, supply, general price index, inflation and deflation. Budget-public revenue and public expenditure. Tax: meaning, direct and indirect taxes, agricultural taxation, VAT/GST. Economicplanning - 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 and indirect taxes discussion-economic planning and 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, equi marginal 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 – consumer's 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 increase and 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
13. Budget discussion
14. Taxes- direct and indirect taxes discussion
15. Economic planning and NITI ayog discussion
16. SDG -discussion
17. **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 macroeconomics.

CO 2: To know the principles of economics and its application

CO 3: To acquire the practical exposure on application of economic principles related toagriculture.

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-PO Mapping matrix

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

References

1. Dewett, K.K., 2010. Modern Economic Theory, Syamlal Charitable Trust, New Delhi.
2. Subba Reddy,S. *et al.,* 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. Principles of Economics, Progressive Corporation Pvt., Chennai.
5. Samuelson,P., 2004. Economics, Tata Mc Graw 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

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 of technology.
- To understand the scope and importance of agricultural journalism and state the sources of 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 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 influencing rate 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 by the 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 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 stage models.
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 light of market led 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 current stream of thoughts

Practical schedule

1. Visit to the KVK centre 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 district level
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
16. Planning and writing of scripts for electronic media
17. Survey on adoption of agricultural technologies.

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. Aritha Publishing House Hyderabad.
5. Meenambigai J and C. Thatchinamoorthy, 2018. Text book of Extension communication and 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

AEG 101 SOIL AND WATER CONSERVATION ENGINEERING (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 measurementand 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 – plottingand 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. Studyof 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, definition of geodetic and plane surveys, linear measurements (MKS), measurement of distances.
2. Levelling-definition, description of dumpy level and Levelling staff, terminology connected with 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 andarea-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, Geological and 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 like contourbunds, graded bunds, broad based terracing and bench terracing.
16. Wind erosion definition, mechanics of wind erosion and types of soil movement. Principlesof 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**

Reference:

1. Surveying and Leveling Vol.1 by Kanetkar T P and Kulkarni S V 1981. Vidyarthi Griha Praksam, Pune.
2. Land and water Management Engineering by Murthy V V N 1982, Kalyani publishers, NewDelhi.
3. Irrigation Theory and practice by Michael A M 1989. Vikas Publishing House Pvt. Ltd, NewDelhi.
4. Principles of Agricultural Engineering – Vol II. By Michael AM and Ojha TP 1993. Jain

III SEMESTER

AGR 201 CROP PRODUCTION TECHNOLOGY-I (KHARIF CROPS) (1+1)

Learning objectives

- To impart updated technology and skills in performing different operations in the raising ofthe crop.
- To capable of understanding crop statistics and study the constraints for low productivity inIndia and Tamil Nadu.
- The students will gain knowledge about the Kharif crops and their cultivation techniques.
- To knowing cropping systems in India post-harvest operations in different crops.
- Learn about seed production, Farm Mechanization and resource conservation technology.

Theory

Unit - I: Cereals

Rice, Maize, - Origin, geographic distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and yield.

Unit - II: Millets

Sorghum, Pearl millet, Small millets - Finger millet, Foxtail millet, little millet, Kodo millet, Barnyard millet and Proso millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Unit - III: Pulses

Redgram, Blackgram, Greengram, Cowpea, - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

Unit - IV: Oilseeds

(Kharif) Groundnut, sesame, Soybean- Origin, and geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Unit - V: Fibre and forage

Cotton, jute, fodder sorghum, cumbu napier- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield

Practicals

Rice 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 crop germination

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 ofcrop varieties, and important agronomic experiments at an experimental farm. Study of forage experimentation, morphological description of kharif season crops. Visit research centres for related crops.

Lesson plan

Theory Schedule

1. Importance and area, production and productivity of major cereals and millets of India and Tamil Nadu.
2. Importance and area, production and productivity of pulses and oilseeds crops of India and Tamil Nadu.
3. Rice - Origin - geographic distribution - economic importance - varieties - soil and climatic requirement.
4. Rice - cultural practices - yield - economic benefits.
5. Special type of Rice cultivation – SRI - and Hybrid rice cultivation.
6. Maize - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
7. Sorghum and Pearl millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
8. Finger millet and Minor millets - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.
9. **Mid semester Examination.**
10. Pigeon pea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield.

11. Green gram, Black gram and Cowpea - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield - Agronomy of rice fallow pulses.
12. Groundnut - Origin, geographical distribution, economic importance, soil and climatic requirements - varieties, cultural practices yield and economics.
13. Sesame and Soybean - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
14. Cotton - Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
15. Jute- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
16. Fodder sorghum- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.
17. Cumbunapier- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield.

Practical Schedule:

1. Identification of cereals, millets, pulses and oilseed crops in the crop cafeteria.
2. Practicing various nursery types and main field preparation for rice crop.
3. Nursery and main field preparation for important millets, pulses and oilseeds.
4. Acquiring skill in different seed treatment techniques in important kharif crops.
5. Estimation of plant population per unit area for important kharif crops.
6. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for cereals and millets.
7. Acquiring skill in field preparation, sowing and manuring of crops under pure and intercropping situations for pulses and oilseeds.
8. Acquiring skill in using seed drill for sowing operations.
9. Acquiring skill in foliar nutrition for important field crops.
10. Observations on growth parameters of cereals and millets.
11. Observations on growth parameters of pulses and oilseeds.
12. Study of yield parameters and estimation of yield in cereals and millets.
13. Study of yield parameters and estimation of yield in pulses and oilseeds.
14. Working out cost and returns of important cereals, millets, pulses and oilseeds crops.
15. Visit to farmers field / research stations to study the cultivation techniques of cereal, millets, pulses, cotton and oilseeds.
16. Visit to nearby Agricultural Research Station / Farmer's field.
17. **Practical Examination**.

Course Outcome

CO1: To understand the importance of food grain requirement and cultivation of major cerealcrops

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 pulsecrops
CO4: To construct idea regarding knowledge on growing of legume and perennial fodders andits preservation
CO5: To create awareness about role of green manures in soil fertility

CO-PO Mapping matrix

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

References

1. Ahlawat, I.P.S., Om Prakash and G.S.Saini. 2010. Scientific Crop Production in India. RamaPublishing House, Meerut.
2. Rajendra Prasad 2006. Text Book of Field Crops Production. ICAR, New Delhi.
3. Subashchandra Bose M, BalakrishnanV. 2001. Forage Production. South Asian Publishers,Delhi
4. Singh, C., Singh, P. and Singh, R. 2003. Modern Techniques of Raising Field Crops. Oxfordand IBH Publishing Co., Pvt., Ltd., New Delhi.
5. Singh, A.K. 2020. Textbook Series: Introduction to Major Field Crops (As per 5th DeansCommittee Syllabus), Agrotech publishing academy, Udaipur.

E-resources

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

AGR 202 IRRIGATION AND WEED MANAGEMENT (1+1)

Learning Objectives:

- To impart knowledge on weed biology and ecology and its usefulness in weed management.
- To develop the mastery of weed identification. To understand different methods of weed management including herbicides, their mode of action 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 weed management.
- 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 andimportance of drainage.

Theory

Unit I: Weed biology and ecology

Introduction to weeds- definitions, characteristics of weeds, their harmful and beneficial effects on 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. Weed management in field crops. Aquatic, problematic, invasive alien weeds and their management. Sustainable weed management concepts for climate change. Current stream of thoughts.

Unit III: Herbicides and herbicide resistance

Herbicides- definition, advantages and limitation of herbicide usage in India. New developments in herbicides- classification, formulations and methods of application. Concept of adjuvants, surfactant and their use. 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 IV: Importance, history and role of irrigation water soil water availability and its measurement

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. 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-extraction Pattern – soil water movement - theories of soil water availability – measurement of soil moisture by direct and indirect methods – relative merits and demerits.

Unit V: Irrigation requirement and CWR, Irrigation scheduling its methods and WUE, Irrigation water quality, its management and drainage

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 watersoluble fertilizers. 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

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 equipment's 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.

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 sprinklerirrigation 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. 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. Aquatic, parasitic and obnoxious weeds
3. Life cycle of weeds, weed migration, weed seed distribution. Weed dormancy, germination, establishment and perennation of weeds in different ecosystems. Crop weed interactions – Critical crop weed competition, competitive and allelopathiceffects of weeds and crops.

4. Principles and methods of weed management: Preventive, cultural, mechanical, chemical, biological and alternate method- IWM in crops and cropping systems – Agricultural crops
5. Classification and characteristics of herbicides, methods of herbicide application and herbicide formulations – History and Development- Herbicide use efficiency – Adjuvants, herbicide protectants and antidotes – Herbicide and herbicide mixtures in India – Interaction with moisture, fertilizer and other agrochemicals.
6. Herbicides absorption and translocation – Mechanism of action of herbicides and theirselectivity. Herbicide persistence and degradation in plants and soils – Herbicide residue and their management. Herbicide resistant weeds and their impact on weed management. Success of herbicide resistant crops (HRC) in Indian and World agriculture
7. Aquatic, problematic, invasive alien weeds and their management and sustainable weed management concept for climate change- Current stream of thoughts
8. Irrigation–importance, definition and objectives. Water resources of India and Tamil Nadu– surface and ground water resources–Irrigation development– Important major irrigation projects. Role of water in plant growth, command area development, water budget and management
9. **Mid semester Examination**
10. Soil plant atmospheric continuum and soil-water relations-physical properties of soil – effective root zone depth–moist ure extraction pattern– moisture sensitive periods of important crops. Water retention in soil – adhesion and cohesion – soil moisture tension - pF - Soil moisturecharacteristic curves -water movement in soils–infiltration–percolation–hydraulic conductivity– saturated and unsaturated waterflow.
11. Kinds of water in soil–gravitational water-capillary water- hygroscopic water. soil moistureconstants- saturation capacity - field capacity – permanent wilting point –available soil moisture – hygroscopic coefficient – theories of soil water availability –moisture retentivecapacity viz., FC, PWP and ASM.
12. Measurement of soil moisture–Direct methods: gravimetric and volumetric method, infra- 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.
13. Evaporation, transpiration, ET and ETO–factors influencing Evapotranspiration-daily, seasonal and peak period consumptive use. Crop co-efficient–crop co-efficient curve-water requirement–irrigation requirement–net and gross irrigation requirement–irrigation interval–irrigation period–seasonal water requirement of important crops. critical stages of irrigation water requirements of major field crops
14. 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. 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

15. Surface irrigation methods–flooding, check basin, ring basin, border strip, furrow and corrugations–advantages and dis advantages. Micro irrigation-sprinkler, drip irrigation method–definition-advantages and disadvantages-fertigation, scheduling in drip irrigation method –recommended water-soluble fertilizers
16. Study of various weirs and flumes – water use efficiency (WUE)–c rop water use and field water use efficiency–factors influencing WUE. Quality of water salinity hazard, SAR – Sodium adsorption ratio, sodicity hazard, residual sodium carbonate and boron toxicity-c riteria and threshold limits– management practicesfor using poor quality water
17. Agricultural drainage–surface and sub-surface drainage systems–relative merits and suitability to different soils. Irrigation management under limited water supply and conjunctive use of surface and ground water.

Practical Schedule

1. Identification, classification and characterization of wet land, dryland and garden land weeds-problematic and parasitic weeds.
2. Biology and survey of weeds in cropped area and other habitats. Techniques of weed preservation - Herbarium preparation.
3. Estimation of soil weed seed bank and seed production potential of problematic weeds.
4. Calculations on weed indices (WCE and WI)
5. Study of commonly available herbicides in the market, their nomenclature and label information. Study of herbicide formulations and mixture of herbicides. Computation of herbicide doses.
6. Study of herbicide application equipment and calibration. Herbicide application methods and precautionary measures.
7. Herbicide phytotoxicity scoring under field conditions and its compatibility with agrochemicals. Herbicide residue analysis.
8. Determination of bulk density and soil moisture content by gravimetric and volumetric methods
9. Installation and working of tensiometer and resistant block in a cropped field
10. Determination of field capacity and permanent wilting point by field method
11. Measurement of irrigation water through flumes, weirs and water meters.
12. Scheduling of irrigation by IW/CPE ratio method. Calculation of irrigation water needs (problems)
13. Demonstration of surface methods of irrigation (basin, check basin and furrow)
14. Demonstration of drip and sprinkler irrigation system (filter cleaning, flushing of laterals) andcalculation of crop water requirement.

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 create knowledge on facts and information from different sources, pertaining to weed 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. To synthesis idea about various herbicides, formulations and adjuvants. To understand about mechanism and action of herbicides, persistence of herbicides. To construct information regarding management of weeds of field crops, aquatic andproblematic weeds.
CO 3: To understand basic principles and practices of irrigation. To formulate ideas pertaining to soil water plant relationship. 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 different drainagemethods

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 ScienceResearch, 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.
6. Dilip Kumar Majumdar. 2014. Irrigation Water Management-Principles and Practices. Prentice Hall India Learning pvt. Ltd., New Delhi
7. Lenka D. 2005. Irrigation and Drainage. Kalyani publishers, New Delhi.

8. Michael, A.M. 2009. Irrigation: Theory and Practice. Vikas publishing house pvt. Ltd., NewDelhi
9. Mukund Joshi and Prabhakara Setty, T.K. 2013. A Text Book of Irrigation and WaterManagement. Kalyani publishers, New Delhi.
10. 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

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: Breedingthods 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 – comparison between 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 frequencies in 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 descriptionof 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, purelines 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 – disease resistance – 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 – bree¤ing 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 breeder's 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. ParticipatoryPlant 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 angiospermic plant. –Study of floral structure of self pollinated crops – floral biology, antheis, pollination, selfing andcrossing 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 cytoplasmicGenetic 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 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.
4. Self incompatibility – classification – heteromorphic, homomorphic, gametophytic and sporophytic systems of incompatibility – mechanisms of self incompatibility – Relevance of 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

a. 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 breeding methods – 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 – plant introduction 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 of environment 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 –

procedure forevolving a variety by mass selection – modification of mass selection – merits, demerits andachievements.

11. 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 – 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

a. 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 – conclusion of 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 disease resistance

a. breeding methods for disease resistance – achievements – Insect resistance – mechanism of insect resistance in plants (non preference, antibiosis, tolerance and avoidance) – nature ofinsect 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

a. 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 applications in 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, copyrights,
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 and pulses –
   Sunflower and redgram.
6. Types of male sterility – genetic, Cytoplasmic and cytoplasmic Genetic male sterility, transferof 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 for disease 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 of performanceof 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, Advanced Varietal 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 techniques invarious 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 source invarious 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, New Delhi.
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 Publishing Co.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 Hill PublishingCompany 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

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 assess 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 II- 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 acid sulphate 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 the soilquality
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 fluffy paddy soils. Eroded soils and compacted soils: definition, formation, characteristics, effect on 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. Divyajoyti Prakashan, Jodhpur

ENT 201 BENEFICIAL INSECTS AND PRINCIPLES OF INTEGRATED PEST MANAGEMENT (2+1)

Learning objectives

- To explain species, morphology, anatomy and biology of bees and silkworms
- To understand the rearing techniques of honey bees, silkworm, and lac insects.
- To discuss about minor productive insects and their uses.
- To describe helpful insects and their services, injurious insects and their impacts
- To study the basic morphology, biology and extraction techniques of important plant parasiticnematodes.

Theory

Unit I: Classification of insects based on economic importance - Apiculture - Bee species – comparison- castes of bees, bee behaviour and bee dance; Apiary management practices – bee pasturage, foraging, seasonal variations; Bee products – properties and uses; Effect of agricultural inputs on bee activity – pesticide poisoning.

Unit II: Moriculture; Silkworm rearing; Lac insect- biology-strains-natural enemies of lac insect and lac products; Weed killers, pollinators, scavengers and soil builders; Balance of life in nature – population dynamics – role of abiotic and biotic factors. Life table – interspecific and intraspecific relationships

Unit III: Pests – definition and categories – pest outbreak – factors governing pest outbreak– pest monitoring, surveillance and forecasting. Economic Threshold Level – Economic Injury Level- Integrated Pest Management – history, principles and strategies – requirements for successful pest management programme; Cultural, physical, mechanical, ecological engineering methods and host plant resistance in pest management

Unit IV: Parasitoids, predators and microbial agents in pest management. Legal methods – definition – pest introductions – quarantine – phytosanitary certificate – pest legislation. Pesticides – history, classification – mode of action of insecticides. Pesticides compatibility, safety and hazards in the use of pesticides – pesticide poisoning - impact of pesticides in agro-ecosystem.

Unit V: Insecticide act. Insecticides residues and resistance. Semiochemicals – allomones – kairomones – pheromones- semiochemicals in pest management. Sterile male technique – chemosterilants, insect growth regulators – moult inhibitors – Juvenile Hormone mimics – antifeedants and repellents. Natural pesticides. Biotechnology in pest management. Bio safety of transgenic plants. Impact of global warming on pests. Bio-intensive/Bio-rational/ Eco-friendly Integrated Pest Management – Indigenous/traditional technologies in Integrated Pest Management

Practical

Identification, morphology and structural adaptations in honey bees. Bee keeping appliances, bee enemies and diseases. Sericulture. Lac insect-life history, hosts and culturing of lac, natural enemies and lac products. Study of useful insects- Pollinators, weed killers, scavengers and soil builders. Symptoms and types of damage caused by insect pests. Assessment of insect population and their damage in field crops. Cultural, mechanical and physical control of insects. Identification and mass culturing of different types of parasitoids, predators and entomopathogens. Behavioral approaches in pest management – Pheromone traps, light traps, sticky traps and others. Pesticide formulations and toxicity parameters. Pesticide application techniques. Preparation of spray fluids and botanicals for field application. Plant protection appliances.

Theory lecture schedule

1. Economic classification of insects
2. Bee species – comparison – castes of bees – bee behaviour and bee dance
3. Apiary management practices – bee pasturage – foraging – seasonal variations.
4. Bee products – their properties and uses
5. Effect of agricultural inputs on bee activity – pesticide poisoning
6. Ecological requirements for mulberry cultivation – soil type – mulberry varieties – Methods of propagation – merits and demerits – selection of semi hard wood cuttings
7. Pests and diseases of mulberry
8. Types of silkworm - Mulberry silkworm – origin – classification based on voltinism, moultinism, geographical distribution and genetic nature – Characters of multivoltine races, bivoltine races, cross breeds and bivoltine hybrids – double hybrids– suitability for rearing in different seasons.

9. Morphology and biology of silkworm – sexual dimorphism in immature and adult stages – silkworm genetics – chromosome number – sex limited characters in egg, larva and cocoon for grainage use.
10. Lac insect- biology-strains-Natural enemies of lac insect and lac products
11. Weed killers, pollinators, scavengers and soil builders
12. Insect ecology – definition – balance of life in nature – reproductive potential and environmental resistance
13. Population dynamics – role of biotic factors – competition – parasitoids and predators. Life table – Interspecific and intraspecific relationship
14. Abiotic factors – physical, nutritional and host plant associated factors on insect population.
15. Pests – definition, categories and causes for outbreak of pests. Losses caused by pests
16. Pest monitoring – pest surveillance and forecasting – objectives, survey, sampling techniques and decision making. Economic Threshold Level and Economic Injury Level. Factors influencing Economic Injury Level and Economic Threshold Level
17. **Midsemester examination**
18. Integrated Pest Management – history, principles and strategies – requirements for successful pest management programme. Components of pest management
19. Cultural methods – definition – characteristics, requisites – farm level practices and community level practices, advantages and disadvantages- Ecological Engineering in pest management
20. Physical methods – definition – use of heat, moisture, light, electromagnetic energy and sound energy – Mechanical methods – definition – mechanical destruction and exclusion – merits and demerits
21. Host plant resistance – types and mechanisms of resistance and role of host plant resistance in pest management
22. Biological control – definition, parasitoids and predators and their role in pest management
23. Microbial control – viruses, bacteria, fungi, protozoa and nematodes and their role in pest management
24. Legal methods – definition – pest introductions – quarantine – phytosanitary certificate – pest legislation
25. Chemical control – definition – history of insecticide development – toxicity parameters – ideal qualities of an insecticide
26. Classification of insecticides based on mode of entry, mode of action and chemical nature
27. Mode of action of organophosphates, carbamates, synthetic pyrethroids, neonicotinoids, diamides and avermectins
28. Pesticide compatibility, safety and hazards – pesticide poisoning - antidotes – safe handling – impact of pesticides on agroecosystems
29. Insecticides Act 1968 – insecticide residues and waiting periods, role of pesticides in pest management, insecticide resistance management

30. Semiochemicals – definition – intraspecific semiochemicals – allomone, kairomone, synomone and apneumone - Interspecific semiochemicals – pheromone, sex pheromone, alarm and trail marking pheromone. Pheromones in Integrated Pest Management
31. Sterility methods – definition – principles – methods – requirements and limitaitons
32. Insect growth regulators – moult inhibitors – Juvenile Hormone mimics – mode of action and uses. Insect antifeedants and repellents – mode of action, groups and uses
33. Botanicals and Biotechnological approaches in pest management – bio safety of transgenic plants
34. Impact of global warming on pests. Integrated Pest Management: Issues and options. Bio-intensive/Bio-rational/ Eco-friendly Integrated Pest Management – Indigenous/traditional technologies in Integrated Pest Management

Practical schedule

1. Identification, morphology and structural adaptations in honey bees
2. Bee keeping appliances, bee enemies and diseases
3. Mulberry nursery bed preparation – methods of planting - Pruning methods – leaf / shoot harvest– preservation of leaves.
4. Identification of damage symptoms of insects, diseases and nematodes of mulberry
5. Chawki rearing and shoot rearing
6. Lac insect-life history, hosts and culturing of lac, natural enemies and lac products
7. Study of useful insects-Pollinators, weed killers, scavengers and soil builders
8. Symptoms and types of damage caused by insect pests, Assessment of insect population and their damage in rice, cotton and brinjal
9. Cultural, mechanical and physical control of insects
10. Identification and mass culturing of different types of parasitoids
11. Identification and mass culturing of different types of predators
12. Identification and mass production of entomopathogens
13. Behavioral approaches in pest management – Pheromone traps, light traps, sticky traps and others
14. Pesticide formulations and toxicity parameters
15. Pesticide application techniques, Preparation of spray fluids and botanicals for field application
16. Plant protection appliances
17. **Final Practical examination**

References

1. David, B.V. and V.V. Ramamurthy. 2011. Elements of Economic Entomology, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}
2. Pedigo, L.P. and M.E. Rice.1996. Entomology and Pest Management. Prentice-Hall of India Pvt. Ltd., New Delhi. 812p. {ISBN-978-8120338869}
3. Dhaliwal, G.S. and R. Arora. 2001. Integrated Pest Management – Concepts and approaches. Kalyani publishers, New Delhi. 427p. {ISBN: 81-7663-904-4}

4. Dandin, S.B., J. Jayaswal and K. Giridhar.2003. Hand book of Sericulture Technologies. Central Silk Board, Bangalore, 287 p.

e-resources

1. http://www.sristi.org/hbnew
2. http://www.ncipm.org.in/recent-publications.htm
3. http://www.ipmnet.org
4. www.silkbase.org
5. www.papilo.ab.a.u.tokyo.ac.jp

Assignment

- Collection and submission of 25 herbaria of symptoms of insect damage
- Collection and submission of 50 Nos. of beneficial and harmful insects

Course Outcome

CO1: Gain knowledge on productive insect - Honeybees
CO2: Gain knowledge on productive insect – Silkworm and Lac insects
CO3: Gain knowledge on pests and damage levels
CO4: Gain knowledge on Integrated Pest Management
CO5: Gain knowledge on Insecticides and application methods

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

PAT 201 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

Plant Pathology- Definition - History- Economic importance of plant diseases- Plant Pathogenic organisms – Protozoa, Phytomonas, chromista, Fungi, Bacteria, *Candidatus*

Phytoplasma, Spiroplasma, Fastidious vascular bacteria, Viruses, Viroids, Algae, and Phanerogamic parasites

Unit II: Pathogenesis

Koch's postulates- Pathogenesis - Mode of infection – pre-penetration, penetration and post penetration – Mode of infection, Survival and Spread - Role of enzymes and toxins on disease development-Effect of pathogen on physiological functions of the plants

Unit III: General characters and taxonomy of Protozoa, Chromista and Fungi

General characters– somatic structures, types of mycelia - reproduction (Vegetative, asexual and sexual) – Types of parasitism. Classification (Kirk *et al.,* 2001) and symptoms of, Kingdom: Protozoa, Phylum: Plasmodiophoromycota, *Plasmodiophora brassicae*, Kingdom: Chromista, Phylum: Oomycota - *Pythium, Phytophthora, Sclerospora*, *Plasmopara* and *Albugo* Kingdom: Fungi, Phylum: Chytridiomycota - *Synchytrium,* Phylum: Zygomycota - *Mucor*, *Rhizopus*

Unit IV: General characters and taxonomy of Fungi- Ascomycota and Basidiomycota

Phylum: Ascomycota - *Taphrina*, *Capnodium, Mycosphaerella, Macrophomina, Cochliobolus, Lewia, Venturia, Eurotium, Talaromyces, Sclerotinia, Erysiphe, Leveillula, Phyllactinia,Claviceps, Gibberella, Ustilaginoidea, Verticillium, Glomerella, Pestalotiopsis andMagnaporthe,* Phylum: Basidiomycota - *Puccinia*, *Uromyces*, *Hemileia, Ustilago, Sphacelotheca (Sporisorium)*, *Tolyposporium (Moesziomyces), Exobasidium, Sclerotium, Rhizoctonia* (*Thanatephorus*), *Ganoderma, Agaricus*, *Pleurotus, Volvariella* and *Calocybe.*

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

General characters and symptoms- phytopathogenic bacteria,*Candidatus Phytoplasma*, Spiroplasma, Fastidious vascular bacteria, viruses, viroids, algae, Phanerogams –Abiotic disorders.

Practical

General characters of fungi – Types of mycelia -Types of vegetative, asexual and sexual spores- asexual and sexual fruiting bodies .Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium Phytophthora*, *Sclerospora*, *Plasmopara* , *Albugo*, *Mucor*, *Rhizopus, Taphrina, Capnodium, Cercospora,* (*Mycospaerella*), *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* and *Calocybe.* Symptoms of bacterial diseases, *Candidatus Phytoplasma*, Fastidious vascular bacteria, algal parasite, phanerogamic parasites and non- parasitic diseases

Lesson plan

Theory schedule

1. Definition of Plant Pathology – History of Plant Pathology - Losses caused by plant

diseases

2. Causes of Plant diseases – Protozoa , Chromista, , fungi, Bacteria, Fastidious vascular bacteria,Spiroplasma, *Candidatus Phytoplasma,*
3. Causes of Plant diseases -Virus, viroid, algal, phanerogamic parasites and abiotic disorders
4. Pathogenesis – stages in pathogenesis – pre-penetration, penetration and post penetration
5. Role of enzymes in disease development
6. Role of toxins in disease development
7. Effect of pathogen on physiological functions of the plants- Effect on Photosynthesis-Transpiration-Respiration- translocation of water and nutrients
8. General characters of fungi- Mycelia – vegetative resting structures
9. Asexual reproduction in fungi
10. Sexual reproduction in fungi
11. Parasitism in fungi- Types of parasitism – parasite, saprophyte, obligate parasite, facultative parasite, facultative saprophyte- Mode of nutrition in fungi- biotrophs, hemibiotrophs, perthotrophs/ necrotrophs and symbiosis
12. Classification of Kingdom Protozoa - important taxonomic characters , symptoms and life cycle of
13. *Plasmodiophora brassicae* and symptoms of Protozoan diseases
14. Classification of Kingdom Chromista- General characters of Oomycetes- Symptoms and life cycleof *Pythium, Phytophthora* and *Albugo*
15. Symptoms and life cycle of *Sclerospora and Plasmopara*
16. Classification of Kingdom– Chytridiomycota and Zygomycota - important characters, symptoms andlife cycles of *Synchtrium* and *Rhizopus* and *Mucor*
17. **Mid Semester Examination**
18. Classification of Kingdom– Ascomycota- important characters
19. Symptoms and life cycles of *Taphrina, Capnodium, Cercospora,* (*Mycospaerella*), *Macrophomina,Cochliobolus (Helminthosporium)*, *Lewia* (*Alternaria)* and *Venturia*
20. Symptoms and life cycles of *Eurotium, Talaromyces*, *Erysiphe, Leveillula* and *Phyllactinia,*
21. Symptoms and taxonomic characters of *Claviceps, Fusarium* (*Gibberella, Nectria*) and *Verticillium*
22. Symptoms and taxonomic characters of *Colletotrichum (Glomerella) Pestalotia (Pestalosphaeria),Pyricularia* (*Magnoporthe*) ,*Sarocladium and Ustilagenoidea*
23. Classification of Kingdom - Basidiomycota- important characters
24. Symptoms and life cycles of *Puccinia ,Uromyces, Hemileia*
25. Symptoms and taxonomic characters of *Ustilago, Sphacelotheca (Sporisorium)*, *Tolyposporium(Moesziomyces), Tilletia and Exobasidium*
26. Symptoms and taxonomic characters of *Athelium, Thanetephorus* and *Ganoderma*
27. Important taxonomic characters of *Agaricus, Pleurotus* and *Calocybe*
28. Classification and general characters of phytopathogenic bacteria
29. Symptoms and characters of *Xanthomonas*, *Ralstonia, Erwinia, Pantoea*, *Pectobactrium,*

Agrobacterium (Rhizobium), *Corynebacterium* (*Clavibacter*,) and *Streptomyces*

30. Important characters and symptoms of *Candidatus Phytoplasma* diseases – Phyllody, little leaf,yellow dwarf and sandal spike, Fastidious vascular bacteria and Spiroplasma
31. Virus - definition, nature and properties of plant virus, Single stranded, Double stranded RNA andDNA viruses and Transmission of plant viruses
32. Common symptoms of virus diseases – mosaic, chlorosis, leaf curl, stem pitting, spotted wilt,necrosis , ring spot, vein clearing, leaf crinkle, rosette and bunchy top
33. Important characters and symptoms of Viroid, Algal and Phanerogamic parasites
34. Symptoms and characters of non-parasitic diseases

Practical Schedule

1. General characters of fungi – Types of mycelia -Types of vegetative, asexual and sexual spores-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 Plasmopara* and *Albugo*
4. Study of important taxonomic characters and symptoms produced by *Rhizopus, Taphrina, Capnodium, Cercospora,* (*Mycospaerella*), *Botryodiplodia* (*Botryosphaeria*)*, Drechslera* (*Helminthosporium)* and *Alternaria*
5. Study of important taxonomic characters and symptoms produced by *Eurotium, Talaromyces*, *Erysiphe, Leveillula, Phyllactinia, Uncinula* , *Podosphaera and Sphaerotheca*
6. Study of important taxonomic characters and symptoms produced by *Claviceps, Fusarium* (*Gibberella, Nectria*) and *Verticillim*
7. Study of important taxonomic characters and symptoms produced by *Colletotrichum (Glomerella), Pestalotia (Pestalosphaeria), Pyricularia* (*Magnoporthe*) *Sarocladium* and *Macrophomina*
8. Study of important taxonomic characters and symptoms produced by *Puccinia*, *Uromyces*, and *Hemileia*
9. Field visit for exposing students on different crop diseases
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* and *Volvariella*
12. Study of important taxonomic characters and Symptoms produced by *Athelium, Thanetephorus* and *Ganoderma*
13. Symptoms of bacterial diseases – leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.
14. Symptoms of *Candidatus Phytoplasma* and Algae
15. 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
16. Phanerogamic parasites and non-parasitic diseases

17. **Final Practical Examination.**

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, Phylum Zygomycota, 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. MedtechPublishers.
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

ENS 201 ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT (2+1)

Theory

Unit 1: Multidisciplinary nature of environmental studies Definition, scope and importance

Unit 2: Natural Resources: Renewable and non-renewable resources Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems • Concept of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids. • Introduction, types, characteristic features, structure and function of the following ecosystem. a. Forest ecosystem. b. Grassland ecosystem. c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 4: Biodiversity and its conservation:- Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit 5 : Environmental Pollution: Definition, cause, effects and control measures of : a. Air pollution. b. Water pollution. c. Soil pollution. d. Marine pollution. e. Noise pollution. f. Thermal pollution. g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies.

Unit 6: Social Issues and the Environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water

(Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Unit 7: Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

DISASTER MANAGEMENT

Unit 8: Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

Unit 9 : Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Unit 10 : Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community - based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

Practical

Field work: Visit to a local area to document environmental assets river/forest/grassland/hill/mountain, visit to a local polluted site - Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

Lecture Schedule

1. Multidisciplinary nature of environmental studies - Definition, scope and importance - Natural Resources: Renewable and non-renewable resources - Natural resources and associated problems
2. Forest resources: Use and over-exploitation, deforestation, case studies - Timber extraction, mining, dams and their effects on forest and tribal people
3. Water resources: Use and over-utilization of surface and ground water - Floods, drought, conflicts over water, dams - benefits and problems
4. Mineral resources: Use and exploitation, environmental effects of extracting and using mineralresources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing
5. Effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies.

6. Land resources: Land as a resource, land degradation, man induced landslides - Soil erosion and desertification - Role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles
7. Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids
8. Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem and Desert ecosystem
9. Introduction, types, characteristic features, structure and function of Aquatic ecosystems : ponds, streams, lakes - Rivers, oceans, estuaries
10. Biodiversity and its conservation - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values
11. Biodiversity at global, National and local levels - India as a mega-diversity nation - Hotspots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
12. Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
13. Environmental Pollution - Definition, cause, effects and control measures of Air pollution and Noise pollution
14. Definition, cause, effects and control measures of Water pollution and Soil pollution
15. Definition, cause, effects and control measures of Marine pollution, Thermal pollution and Nuclear hazards
16. Solid Waste Management: Causes, effects and control measures of urban and industrial wastes
17. **Mid Semester Examination**
18. Role of an individual in prevention of pollution - Pollution case studies - Social Issues and the Environment - From Unsustainable to Sustainable development - Urban problems related to energy
19. Water conservation, rain water harvesting, watershed management - Environmental ethics: Issues and possible solutions, climate change, global warming
20. Acid rain, ozone layer depletion, Nuclear accidents and holocaust - Wasteland reclamation-Consumerism and waste products
21. Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act
22. Issues involved in enforcement of environmental legislation - Public awareness - Human Population and the Environment: Population growth, variation among nations, population explosion, Family Welfare Programme
23. Environment and human health: Human Rights, Value Education, HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health - Case Studies
24. **Disaster Management -** Natural Disasters - Meaning and nature of natural disasters, their types and effects - Floods, drought
25. Cyclone, earthquakes, Landslides, avalanches

26. Volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion
27. Man Made Disasters - Nuclear disasters, chemical disasters, biological disasters, Building fire, coal fire, forest fire, oil fire
28. Air pollution, water pollution, deforestation, industrial waste water pollution
29. Road accidents, rail accidents, Air accidents, sea accidents
30. Disaster Management - Effect to migrate natural disaster at national and global levels
31. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements
32. Role of NGOs, community - based organizations and media in disaster management
33. Central, state, district and local administration in disaster management
34. Armed forces in disaster response - Disaster response; Police and other organizations.

Practical schedule

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

Course outcomes

CO 1: Students gain the knowledge environmental studies, basics and natural resources
CO 2: Students learn to explain ecosystems, biodiversity and its conservation
CO 3: Students learn about environmental pollution and social issues
CO 4 : Students learn about natural and manmade disaster
CO 5 : Students gain knowledge on disaster management

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. Erach Bharucha, Text book for Environmental studies. University Grants Commission, New Delhi
2. Tyler Miller and Scot Spoolman. 2009. Living in the Environment (*Concepts, Connections, and Solutions).* Brooks/cole, Cengage learning publication, Belmont, USA
3. P.D. Sharma, 2009, Ecology and Environment, Rastogi Publications, Meerat, India
4. De. A.K., 2010. Environmental chemistry. Published by New Age International Publishers, New Delhi. ISBN:13–978 81 224 2617 5. 384 pp

E-References

1. Dhar Chakrabarti. P.G., 2011. Disaster management - India's risk management policy frameworks and key challenges. Published by Centre for Social Markets (India), Bangalore. 36 pp.
2. Proceedings of 2nd India disaster management congress, New Delhi. Organized by National Institute of Disaster Management, New Delhi during 4 – 6, November 2009.

HOR 201 PRODUCTION TECHNOLOGY OF VEGETABLES AND SPICES (1+1)

Learning objectives

- To learn about the nursery practices, planting methods of vegetable crops.
- To learn about the cultivation techniques, maturity indices, harvesting techniques of vegetable 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

Vegetables

Unit I: Scope, Importance and classification of vegetables

Importance of vegetable growing –area and production of vegetables in India and Tamil Nadu- National economy- nutritive value of vegetables and human nutrition.

Unit II: Production technology of tropical vegetable crops

Origin - climate and soil – varieties and hybrids – seeds and sowing – transplanting – water and nutrient management – fertigation – weed management – use of micronutrients and plant growth regulators - physiological disorders - maturity indices – harvest – pest and diseases – seed production

Crops: Tomato, chilli, brinjal, bhendi, gourds (ash gourd, pumpkin, bitter gourd, ridge gourd, bottle gourd, snake gourd and watermelon) onion, cassava, amaranthus and moringa.

Unit III: Production technology of temperate vegetable crops

Origin -climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrient and plant growth regulators-physiological disorders- maturity indices – harvest – pest and diseases – seed production

(**Crops:** Cabbage, cauliflower, potato, carrot, radish, beetroot, peas and french beans, Protected cultivation of vegetables (tomato, capsicum and cucumber).

SPICES

Unit IV: Crop production techniques of major spices

Spices- scope and importance - classification of spices - origin, area and production - role of commodity boards- export potential of spices.

Climate and soil - varieties - propagation - nursery management and planting – cropping systems-training practices - nutrient, water and weed management - shade regulation - maturity indices - harvest and yield - pests and diseases - processing - value addition.

Black pepper, Cardamom, Turmeric, Ginger and Garlic

Unit V: Crop production techniques in seed spices, tree spices and other spices

Climate and soil- varieties - propagation, nursery management and planting- training , pruning canopy management- weed and water management- shade regulation- nutrient management including drip and fertigation – harvest and yield – pests and diseases – processing – value addition.

Coriander, Fenugreek, Cumin, Fennel, Clove, Nutmeg, Cinnamon, Curry leaf, Tamarind and Herbal spices

Practical

Vegetables

Layout of kitchen garden – seed sowing – nursery management – grafting in vegetables water and nutrient management – fertigation – weed management – practices in use of plant growth regulators - Special horticultural practices in vegetable production - study of maturity indices - Identification of physiological disorders - protected cultivation - visit to vegetable nursery unit/ protected cultivation unit.

Spices

Identification of spices - description of varieties - Propagation methods - rapid multiplication techniques

Seed collection and extraction - raising of nurseries - seed sowing - seed treatment - fertilizer application - harvesting – pests and diseases - processing - cost economics - visit to spice gardens

Black pepper, Cardamom, Turmeric, Ginger, Coriander, Fenugreek, Curry leaf, Clove, Nutmeg and Cinnamon

Theory lecture schedule

1. Importance of vegetable growing –area and production of vegetables in India and Tamil Nadu- National economy- nutritive value of vegetables and human nutrition.
2. Climate and soil – varieties and hybrids – seeds and sowing – transplanting - water and nutrient management – fertigation – weed management – use of micronutrients

and plant growth regulator - physiological disorders - maturity indices – harvest and yield – pest and diseases – seed production of tomato, chilli and brinjal

3. Production Technology of bhendi and onion.
4. Production Technology of gourds (ash gourd, pumpkin, bitter gourd, ridge gourd, bottle gourd, snake gourd and watermelon)
5. Production Technology of cassava and potato
6. Production Technology of moringa and amaranthus.
7. Production Technology of cabbage and cauliflower.
8. Production Technology of carrot, beetroot and radish.
9. **Mid -semester examination**
10. Production Technology of french beans and peas.
11. Protected cultivation of vegetables (tomato, capsicum and cucumber)
12. Spices- scope and importance - classification of spices - origin, area and production - role of commodity boards- export potential of spices and Production Technology of Black pepper.
13. Production Technology of Cardamom.
14. Production Technology of Turmeric, Ginger and Garlic.
15. Production Technology of Seed spices (Coriander, Fenugreek, Cumin and Fennel).
16. Production Technology of Tree spices (Clove, Nutmeg and Cinnamon).
17. Production Technology of Tree spices (Tamarind, Curry leaf and herbal spices).

Practical schedule

1. Layout of kitchen garden.
2. Seed treatment and sowing practices in direct sown vegetables
3. Nursery management of transplanted ,bulb and tuber vegetable crops
4. Grafting in vegetable crops
5. Water and nutrient management – fertigation in vegetable crops
6. Practices in use of plant growth regulators in vegetable crops
7. Special horticultural practices in vegetable production
8. Identification of physiological disorders in vegetable crops
9. Study of maturity standards and harvesting of vegetables
10. Practices in protected cultivation of vegetable crops
11. Visit to vegetable nurseries/protected vegetable cultivation unit
12. Black pepper and cardamom- identification and description of varieties – seed propagation and vegetative propagation – fertilizers application - preparation of plant bio regulators and application– pests and diseases- harvest and post-harvest practices.
13. Turmeric and ginger- identification and description of varieties- propagation, fertilizers application - preparation of plant bio regulators and application – pests and diseases- harvest and post-harvest practices.
14. Coriander and Fenugreek - identification and description of varieties - seed treatment, sowing fertilizer application - pests and diseases- harvest and post-harvest practices.

15. Clove, Nutmeg and Cinnamon - identification and description of varieties – seed collection and extraction - propagation – fertilizer application – training and pruning – pests and diseases- harvest and post-harvest practices.
16. Tamarind and curry leaf - identification and description of varieties – seed collection and extraction - propagation – fertilizer - application – canopy management – pests and diseases- harvest and post-harvest practices.
17. **Practical Examination**

COURSE OUTCOMES:

CO1: Students will be able to understand the production technology of vegetables, spices and flower crops, its advances and precision horticulture.

CO2: The student will gain skill in managing precision horticulture units.

CO-PO MAPPING MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	3	2	1
CO2	3	3	2	2	3	2

REFEENCES

1. Gopalakrishnan, T.R. 2007. Vegetable Crops. Horticultural Science Series (Series Editor K.V.Peter). New India Publishing Agency.
2. Mandal, R.C. 2006. Tropical root and tuber crops. Agrobios (India) Peter.K.V. 2000. Genetics and Breeding of Vegetables, ICAR, Publication.
3. Singh, P.K., S.K. Dasgupta and S.K. Tripathi, 2006. Hybrid Vegetable Development. International Book Distributing Co.
4. Mini, C. and Krishnakumar, K. 2004. Leaf Vegetables. Agro tech Publishing Academy, Udaipur Thamburaj, S. and Narendra Singh .2001. Vegetables, Tuber crops and Spices, Directorate of information and publications of agriculture, ICAR,NewDelhi.
5. Veeraragavaththam ,D., M.Jawaharlal and SeemanthiniRamadas 2000 " Vegetable Culture"

E-References

1. http://www.jhortscib.com
2. http://journal.ashspublications.org
3. http://www.actahort.org/
4. http://www.aphorticulture.com/crops.htm

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 farmmanagement

- 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 sizeof 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 Inputand Output – Physical and Economic Optimum. Factor –Factor relationship: Least Cost Combination of inputs; Product – Product relationship: OptimumCombination 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 and economic efficiency measures in crop and livestock enterprises. 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. Meaning and importance of farm planning 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 – 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; 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 andsize of farms – Objectives of farm management – Production Economics Vs Farm Management.
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 estimationof 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. actor – 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 recordsneeded 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 bydifferent methods.
3. Application of equi - marginal returns / opportunity cost principle in allocation of farmresources.
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 / horticulturalcrops.
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 andfarm 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, Agroclimatic 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

CO - PO Mapping matrix

	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 toAgriculture, John Wiley, NewYork.
2. Johl, S.S. and Kapoor, T.R., 2000. Fundamentals of Farm Business Management, KalyaniPublications, India.
3. Panda, S.C., 2007. Farm Management and Agricultural Marketing, Kalyani Publications,Ludhiana, India.
4. 4. Raju, V.T. and Rao, D.V.S., 2000. Economics of Farm Production and Management, Oxfordand IBH Publishing Co.Pvt.Ltd. NewDelhi.
5. Kahlon, A.S and Singh K. 1992. Economics of Farm Management in India. Allied Publishers.New Delhi.

E- reference

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/http://eagri.org/eagri50/AECO342/index.html

AEG 201 FARM MACHINERY AND POWER (1+1)

THEORY

Unit I: Farm Power & IC engines

Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of IC engines, comparison of two stroke and four stroke cycle engines , Study of different components of IC engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel supply.

Unit-II: Tractor & functional components

Hydraulic control system of a tractor, Familiarization with Power transmission system clutch, gear box, differential and final drive of a tractor ,Tractor types, Cost analysis of tractor power and attached implement,

Unit –III: **Tillage implements**

Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture.

Unit-IV: **Sowing & Intercultural implements**

Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, implement for intercultural operations.

Unit-V: Plant Protection and Harvesting equipments

Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

PRACTICALS

Study of different components of I.C. engine - To study air cleaning and cooling system of engine - Familiarization with clutch – Transmission - Differential and final drive of a tractor - Familiarization with lubrication and fuel supply system of engine - Familiarization with brake – Steering - Hydraulic control system of engine - Learning of tractor driving - Familiarization with operation of power tiller - Implements for hill agriculture - Familiarization with different types of primary and secondary tillage implements - Mould board plough - Disc plough and disc harrow -Familiarization with seed-cum- fertilizer drills their seed metering mechanism and calibration - Planters and transplanter - Familiarization with different types of sprayers and dusters – Familiarization with different inter-cultivation equipment - Familiarization with harvesting and threshing machinery.

Lecture Schedule:

1. Farm power in India - sources of farm power and their use in agriculture
2. Working principles of IC Engines-Two stroke and Four stroke engines - applications – comparison-Engine terminology.
3. Components of IC engine and systems of IC engine – air cleaning, cooling, lubricating and fuel supply systems.
4. Tractors- types - transmission system- clutch, gearbox, differential and final drive – hydraulic system.
5. Cost analysis of tractor with attached implement.
6. Tillage, objectives, types - ploughing methods. Primary tillage- mould board plough, disc plough, chisel plough and subsoil plough - components and functions, types, advantages and disadvantages
7. Secondary tillage equipment – cultivators, harrows, levelers, land forming equipment – rotovators puddlers - manure tramplers and cage wheels, Implements for Hill agriculture.
8. Sowing methods - seed drills and planters- seed cum fertilizer drills - components and functions- Calibration.
9. **Mid semester examination**
10. Paddy transplanters, types, working principle, field and nursery requirements
11. Implements for intercultural operations – cultivators, sweep, junior hoe, manual weeders and power operated weeders for wet land and garden land
12. Sprayers and their functions, classification, manually operated sprayers, terminology, Nozzle types.

13. Power operated sprayers – Tractor operated boom sprayer, Knapsack mist blower cum duster –Tall tree sprayer-dusters, types and uses.
14. Tools for horticultural crops – propagation tools, planters and harvesting tools and machinery
15. Threshing of crop, thresher and its principles of operation - threshing losses.
16. Harvesting equipment – reapers - mowers and combine harvesters – types, construction and operation-Balers.
17. Harvesting machinery for groundnut, tuber crops, Cotton and sugarcane

Practical Schedule:

1. Study of working of two and four stroke IC engines and their systems with solved problems.
2. Study of Tractor clutch, gearbox, differential and final drive. Study of brake steering, and hydraulic control.
3. Learning driving of tractor and power tiller
4. Study of tractors and power tillers – their operation and maintenance
5. Study of mould board plough, - methods of ploughing- with solved problems.
6. Disc plough and subsoiler and their components- Hitching and adjustment of plough - field operation of different tractor drawn primary tillage machinery.
7. Study of cultivator, disc harrows, Rotavator, bund former, ridger, leveller and puddling implements and their operation.
8. Study of seed drills, planters and seed-cum-fertilizer drills and their components and metering mechanisms - calibration- simple problems on calibration.
9. Study and operation of machinery for rice cultivation - puddling implements- rotary puddlers and cage wheels, tray seeder for rice nursery, transplanters- types operation and maintenance- Drum seeder, conoweeder, power weeder and finger type weeder.
10. Study of different inter-cultivation equipment for uplands - manual, animal drawn, power operated - tractor and power tiller operated - field operation
11. Study of plant protection equipment – manually operated sprayers and dusters, knapsack mist blower cum duster, tractor operated sprayers- their operation, adjustment, calibration and safety requirements
12. Study of tools for Hill agriculture and horticultural crops – propagation tools, vegetable transplanter, harvesting tools -lawn mower, hole diggers, tree climber, shredders for crop residue.
13. Threshing machinery for paddy and identification of its components- different threshing drums - calculation of efficiency and losses.
14. Study of paddy reaper and paddy combine- their systems, method of operation and adjustment.
15. Study of harvesters for root crops - turmeric and tapioca and groundnut diggers
16. Problems on cost of operation of tractor operated machinery.
17. **Final practical examination**

References:

1. Jagadishwar Sahay, 2010 - Elements of Agricultural Engineering. Standard Publishers Distributers, Delhi. ISBN 978-8180140440
2. Ojha, T. P. and Michael, A.M. Principles of Agricultural Engineering. Vol. I, Jain Brothers,

16/893, East Park Road, Karol Bagh, New Delhi – 110005
3. S.C.Jain and C.R.Rai. Farm Tractor – Maintenance and Repair. Standard Publishers, 1705-B, Nai Sarak, Delhi
– 110006
4. Senthilkumar, T., R. Kavitha and V.M.Duraisamy 2015. A Text Book of Farm Machinery, Thannambikkai Publications, Coimbatore . ISBN: 978-9381102305

E- RESOURCES:

www.agricoop.nic.in/dacdivision/Machinery1/directory.htm
www.farmmachineryshow.org
http://www.hillagric.ac.in/edu/coa/agengg/lecture/243/agriengg-243.htm
http://www.digitalbookindex.org/subject_search/search010agricultureequipmenta
http://ecoursesonline.iasri.res.in/course/view.php?id=540

EXT 211 HUMAN VALUES AND ETHICS* (1+0)

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 humanvalues – 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 – selfesteem and self confidence. Art of self improvement – self exploration – self awareness – puttingcapabilities 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 and acquired 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 goalsetting – 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 indecision making – 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 god – form or image – attributes –

relationship – Purpose and benefits – power and acts – meditation – transmitter and receiver – moralityand religion.

13. Positive thinking – assertiveness – coping with life stresses – peer pressure – suicidaltendencies – 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 – meaningand 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 ethics CO 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 InternationalPublishers.
2. Samita Manna and Suparna Chakraborthi, 2010. Values and Ethics in Business and Profession,PHI Learning Pvt Ltd, New Delhi.
3. Jagannadham Challa, 2018. Scientific Values and Professional Ethics in Agricultural Research –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, KalyaniPublishers, 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

IV SEMESTER

AGR 203 CROP PRODUCTION TECHNOLOGY-II (RABI CROPS) (1+1)

Learning objectives

- To impart updated technology and skills in performing different operations in raising thecrop.
- To understand the effect of climate, soil, varieties, and affordable and clean energy.
- To understand the concepts of integrated weed control, integrated nutrient managementand conjunctive use of water.
- To know cropping systems in India and Tamil Nadu, post-harvest operations in differentcrops.
- To learn about farm mechanization and resource conservation technology for sustainabledevelopment for the communities.

Theory

Unit I : Cereals

Wheat, barley, Oats - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Unit II : Pulses

Chickpea, lentil, peas - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Unit – III Oilseeds

Rapeseed, mustard and sunflower- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Unit -IV: Sugar Crops

Sugarcane - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Unit V: Forage crops

Berseem, Lucerne, Fodder maize: Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices.

Practical

Identification of rabi cereals, pulses, oilseeds, sugarcane, and forage crops - nursery preparation and management for sugarcane - main field preparation; Seed treatment techniques - Sowing and manuring Seeding equipment's - Estimation of population - After cultivation practices - Study of growth and yield parameters and yield estimation, harvesting of above crops; Fodder preservation techniques - Silage and hay making, Cost and returns - Visit to institutes and industries - Farmers' fields

Lesson plan

Theory Schedule

1. Wheat- Origin, geographic distribution, economic importance, soil and climatic requirement,
2. Wheat - varieties, cultural practices and yield.
3. Barley and oats - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
4. Chickpea- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
5. Lentil and peas - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
6. Peas - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
7. Rapeseed and Mustard - Origin, geographic distribution, economic importance, Classification , soil and climatic requirement, varieties
8. Rapeseed and mustard - cultural practices, yield.
9. **Mid semester examination**
10. Sunflower- Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
11. Sugarcane - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties
12. Sugarcane - cultural practices and yield.
13. Sugarcane- package of practices for SSI
14. Sugarcane - Crop logging, maturity and ripening
15. Sugarcane - Gur manufacture, Value addition and byproduct utilization.
16. Berseem and Lucerne - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.
17. Fodder maize - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

Practical Schedule

1. Identification of rabi crops and recording their importance in the crop cafeteria.
2. Acquiring skill in field preparation, sowing and manuring of rabi crops under pure and intercropping situations.
3. Acquiring skill in different seed treatment techniques and foliar nutrition of rabi crops.
4. Estimation of plant population per unit area for rabi crops.
5. Nursery preparation for Sugarcane.
6. Acquiring skill in after - cultivation practices in sugarcane - detrashing, and Propping.
7. Study on growth parameters of sugarcane.
8. Study on yield parameters and estimation of yield in sugarcane.
9. Study on yield parameters and estimation of yield in rabi crops.
10. Estimating Cost and returns of important rabi crops.
11. Visit to Sugarcane Breeding Institute/ Research Station to study cultivation of sugarcane and its by products.

12. Visit to - nearby sugar mill, for observing juice extraction, quality assessment, sugar manufacture and by products.
13. Silage making.
14. Practicing field preparation and sowing Lucerne.
15. Practicing field preparation and sowing for fodder maize.
16. Visit to Wheat research station, Wellington to study rabi crops – wheat, barley, rye, oats.
17. **Practical Examination**.

Course Outcomes

CO1: To understand the importance of oil seed production and cultivation of major oilseed crops
CO2: To gain knowledge about importance of sugar crops and its cultivation practices
CO3: To formulate different cropping system and production technologies for Various fibre crops
CO4: To construct idea regarding knowledge on growing of tuber crops
CO5: To create awareness about narcotics crops 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, New Delhi.
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

AGR 204 FARMING SYSTEMS AND SUSTAINABLE AGRICULTURE (1+1)

Learning objectives

- Aims at incurring knowledge on various aspects of cropping and farming system and its importance in present world scenario and its impact on environment and soil health
- To study the evaluation of cropping system
- To study the evaluation of farming system
- To impart knowledge on varied farming enterprises and their integration for sustainableproductivity
- To develop skills on managing resources and labour management

Unit - I: Cropping System

Cropping systems - Definition - Principles - Concepts - Classification - mono cropping - intensive cropping -cropping systems of India and Tamil Nadu - Interaction between different cropping systems - Cropping system management - Resource management - land, nutrient, water and weed.

Unit - II: Evaluation of Cropping System

Index for evaluation of cropping systems - Land use - yield advantages - Economic evaluation - sustainability.

Unit - III: Farming System

Farming systems - Definition - Principles - Concepts - Enterprises selection and management - interaction between different enterprises with cropping - scope and advantages of Integrated Farming system - Integrated farming system models for different agro eco-systems - interaction between enterprises.

Unit - IV: Evaluation of Farming System

Resource recycling in IFS - Evaluation indicators of integrated farming system - LEISA & HEIA - concepts and principles - Conservation agriculture - principles, concept and scope.

Unit - V: Resource and labour management in farming system

Resource management under constraint situation - Cost reduction strategies in crop production - Nonmonetary inputs and lowcost technologies - Labour management - farming system and environment.

Practical

Preparation of cropping scheme - working out input requirements for crops, cropping systems - preparation of calendar of operations for wetland, irrigated upland and dry land cropping system - visit to cropping system experiments - working out indices for evaluation of cropping systems - visit to different units: dairy, goat, poultry, fishery. Mushroom, sericulture and biogas - study on evaluation indicators on farming system - preparation of integrated farming system models for different eco-systems - on farm field visit - analysis of farming system models.

Lesson plan

Theory Schedule

1. Cropping system: Definition, Principles and basic concepts.
2. Classification of cropping system - Mono cropping, intensive cropping, multiple cropping, mixed cropping.

3. Major cropping systems prevailing in India and Tamil Nadu for different agro eco systems.
4. Complementary and competitive interaction in different cropping system - light, nutrient, water and weed.
5. Cropping system management: agronomic requirement for crops and cropping system selection of crops and varieties, tillage and land shaping, plant population and crop geometry.
6. Cropping system management: agronomic requirement for crops and cropping system - water management, soil fertility management and plant protection.
7. Indices for evaluation of cropping system - land use, yield advantage and economics.
8. Farming system: definition, principles and concepts and factors influencing choice and size of enterprises
9. **Mid Semester Examination.**
10. Scope and advantages of integrated farming system.
11. Allied enterprises for wetland, irrigated upland and dryland - selection and management and their interaction. Resource recycling in integrated farming system.
12. Integrated Farming System evaluation indicators.
13. Integrated farming system - models for wetland, irrigated upland and dryland eco system.
14. LEISA and HEIA - principles and concepts and Labour management in integrated farming system.
15. Conservation agriculture and environmental impact of integrated farming system.
16. Cost reduction technologies and non-monetary inputs in integrated farming system.

Practical Schedule:

1. Visit to cropping system experiments in wetland.
2. Visit to cropping system experiments in irrigated upland and dryland.
3. Preparation of cropping scheme for wetland and working out input requirement.
4. Preparation of cropping scheme for irrigated upland and working out input requirement.
5. Calendar of operations for wet land and irrigated upland cropping system.
6. Working out indices for evaluating the cropping system - land use, yield advantage.
7. Working out indices for evaluating the cropping system - Economics, sustainability.
8. Visit to dairy, goat and poultry units.
9. Visit to mushroom unit.
10. Visit to sericulture and biogas unit.
11. Preparation of integrated farming system models: wetland eco-system.
12. Preparation of integrated farming system models: irrigated upland and dryland eco systems.
13. Resource recycling in integrated farming system models of different eco systems.
14. Evaluation of integrated farming system models: wetland eco-system.
15. Evaluation of integrated farming system models: irrigated upland and dryland eco systems.
16. On-farm visit to cropping fields and integrated farming system units.

17. **Practical examination**

Course Outcome

CO 1: To gain the information and acquire practical knowledge on various types of cropping 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 production CO
CO5: 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.pdf
4. http://jnkvv.org/PDF/05042020134251342008 22.pdf.
5. https://www.coabnau.in/uploads/1609844393_Agron.5.6.pdf.

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 the quality 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 crop varieties – 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, Beeder foundation and certified see¤.

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, Sunflower and Groundnut. Foundtion andcertified seed production of Fiber crop – Cotton - Foundation and certified seed production of important vegetables – Tomato, Brinjal and Bhendi.

Unit III: Seed production techniques of commercial important crops 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 - Seedtreatment its importance. Seed Processing – Principles – Equipments Seed certification – Phases of seed certification – Procedure for seed certification – Field inspection.

Unit IV: Post harvest seed handling techniques

Method of application and seed packing- Seed storage – General principles – Stages, factors affecting Seed longevity duringstorage – 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 - Molecular B iochemical test – Detection of genetically modified crops – Transgenecontamination in non- GM crops – GM crops and organic seed production - Seed Act 1966 – Main features of the Seed Act, 1966 – Seed act Enforcement- Duties andpowers 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 analysis of 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 seed technology – 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 seed
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 Seedmultiplication
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 andSorghum
10. Foundation and certified seed production of important pulse crops – Red gram, Black gram
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 of nucleus seed, breeder seed, foundation seed, certified seed in Cucurbits – Ridge gourd, Bottle gourd, Cucumber, Muskmelon and Watermelon
19. Seed production techniques of nucleus seed, breeder seed, foundation seed, certified seed inCole crops – Cauliflower, Cabbage, Radish, carrot and Knol-khol
20. Seed certification – Phases of seed certification – Procedure for seed certification
21. Fieldinspection – 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 otherprocessing equipment - types and Working Principle
24. Seed drying – methods – sun drying – forced air drying – principle of forcedair 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 Qualities estimation
27. Seed Vigour test and Viablity testing
28. Seed storage – general principles – Stages and factors affecting – Seed longevity duringstorage – 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 crops and vegetable crops
7. Germination analysis of field crops and vegetable crops
8. Seed viability test of field crops and vegetable crops
9. Moisture tests of field crops and vegetable corps
10. Seed and seedling vigour tests of field crops 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 variousprinciples 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 andHalmer, 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), Jodhpura

e- Resources

1. https://agritech.tnau.ac.in/
2. https://angrau.ac.in/
3. https://agrimoon.com/

SOL 202 SOIL RESOURCE INVENTORY (1+1)

Theory

Unit-I

Soil Survey: Importance-Definition-Purpose of soil survey- Standard soil survey - Scope and objectives - Fundamental and Applied. Soil systematics- pedon and polypedon, control section and three dimensional nature of soil body. Soil mapping units: Soil series, soil association, soil complex, variants, inclusions and miscellaneous land types.

Unit II

Methods of soil survey: Base maps, Traversing: Grid survey and Free survey.Types of soil survey: Detailed, Reconnaissance, Detailed- Reconnaissance and Semi–Detailed soil survey. Soil mapping.

Unit-III

Soil Classification -Purpose -Early and modern systems -USDA system of soil classification and its advantages. Soil taxonomy - Diagnostic horizons: surface and sub surface-structure and differentiating characteristics and limitations. Soil orders – description. Distribution of Soil orders in world. Soils of India and Tamil Nadu.

Unit-IV

Soil survey reports - Soil Survey Interpretations - Land Capability Classification - Soil and Land Irrigability Classification - Storie Index Rating - Productivity potential - Fertility Capability Classification - Crop suitability: Field crops, horticultural crops and forest trees. Delineation of soils for fertility – Nutrient indexing. Land Use Planning concepts and objectives.

Practical

Site characteristics and Soil Profile description - Morphological study of soil profiles - Estimation of CEC in soil - Estimation of cations and free CaCO3 - Study of base maps- Interpretation of soil survey data and maps - Interpretation of soil data for land capability, crop suitability - Interpretation of soil data for fertility capability classes - Interpretation of soil data for productivity rating - Interpretation of soil data for Nutrient Indexing.

Lecture schedule

1. Soil Survey: Importance-Definition-Purpose of soil survey.
2. Standard soil survey - Its scope and objectives. Fundamental and Applied.
3. Soil systematics - pedon and polypedon, control section and three dimensional nature of soil body.
4. Soil mapping units: Soil series, soil association, soil complex, variants, inclusions and miscellaneous land types.
5. Methods of soil survey: Base maps, traversing: Grid survey and free survey.
6. Types of soil survey: Detailed, Reconnaissance, Detailed- Reconnaissance and Semi–Detailed soil survey. Soil mapping.

7. Soil Taxonomy – Purpose. Early and modern systems. USDA system of soil classification and its advantages.
8. Diagnostic horizons: surface and sub surface.
9. **Mid semester examination**
10. Soil taxonomy – Structure and differentiating characters and limitations.
11. Soil orders, characteristics and their distribution in world.
12. Soils of India and Tamil Nadu.
13. Soil maps, kinds of soil maps and their preparation.
14. Interpretative groupings of soils. Land capability classification and Fertility Capability Classification.
15. Land irrigability classification, Storie index and productivity potential.
16. Land suitability classification for field crops, horticultural crops and forest trees.
17. Land Use Planning - Concepts and objectives - Tropical, subtropical and temperate regions.

Practical schedule

1. Site characteristics and Soil Profile description
2. Morphological study of soil profile 1 (Red soil)
3. Morphological study of soil profile 2 (Black soil)
4. Morphological study of soil profile 3 (Alluvial / Laterite soil)
5. Estimation of CEC in soil
6. Estimation of cations and free CaCO3
7. Study of base maps- Topo sheets and cadastral maps.
8. Study of base maps- Aerial photographs or satellite imageries.
9. Interpretation of soil survey data and maps.
10. Interpretation of soil data for land capability.
11. Interpretation of soil data for crop suitability for field crops.
12. Interpretation of soil data for crop suitability for horticultural crops.
13. Interpretation of soil data for crop suitability for forest trees.
14. Interpretation of soil data for fertility capability classes.
15. Interpretation of soil data for productivity rating.
16. Interpretation of soil data for Nutrient Indexing.
17. **Practical Examination**

Course outcomes

CO 1: Students gain the knowledge soil survey, basics and mapping units
CO 2: Students learn to explain methods and types of soil survey
CO 3: Students learn to soil classification and soil orders

CO 4: Students develop individual skills and ability to analysis and interpret the capability of soil based on Physical and Chemical properties.
CO 5: Students gain knowledge on nutrient index and productivity potential

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. Buol, S.W., Hole, F.D., McCracken, R.J., (1973). Soil genesis and classification. Oxford and IBH publishing Co., New Delhi.
2. Lillesand, T.M. and Kiefer, R.W., 1987. Remote sensing and image interpretation, John Wiley and sons, Inc, New York.
3. Sehgal, J.2005. Pedology concepts and applications, Kalyani Publishers, New Delhi.
4. Soil Survey Division Staff 1999. Soil Survey Manual, USDA publication.
5. Steven, M.D. and Clark, J.A. 1990. Applications of Remote Sensing in Agriculture, Cambridge University, UK.
6. K.L.Totawat 1993. Management of Salt Affected Soils and Water.

E-references

1. ftp://ftp-fc.sc.egov.usda.gov/NSSC/NCSS/Conferences/scanned/
2. *ftp*://ftp-fc.sc.egov.usda.gov/NSSC/Lab_References/SSIR_51.pdf
3. tp://ftp-fc.sc.egov.usda.gov/NSSC/Lab_References/SSIR_51.pdf
4. www.iuss.org/Bulletins/00000096.pdf
5. www.oosa.unvienna.org/pdf/sap/centres/rscurrE.pdf -

PAT 202 PRINCIPLES OF INTEGRATED PLANT 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 ecological management of crop environment
- To acquire knowledge on plant disease survey, forecasting and development and validation of IDM module
- To acquaint with the safety issues in pesticide uses with political, social and legal implication of IDM.

Theory

UNIT I: Epidemiology and Diagnosis of Plant Diseases:

Classification of plant diseases - Disease triangle/ Disease Pyramid - Epidemiology of plant diseases- role of weather factors in disease development - survival and dispersal of plant pathogens- Disease surveillance, assessment and forecasting– Diagnosis of plant

diseases- Seed health tests- chemodiagnosis, serodiagnosis and Molecular diagnosis

UNIT II: Principles – Avoidance, Exclusion and Eradication:
Avoidance- Role of cultural practices in plant disease management. Exclusion- Plant quarantine – domestic, International and Embargo - Phytosanitary certificate- Quarantine in India- Post Entry Quarantine- Exotic diseases introduced into India, Eradication of pathogens from seed and Planting materials – Eradication of diseased plants- Surgery and Rouging – Eradication of Alternate and Collateral host- different methods of eradication- Mechanical, physical , chemical and Biological methods.

UNIT III: Protection, Immunization, Resistance and Biotechnological approaches:
Protection of crops from air borne, seed borne, soil borne and vector borne plant diseases-Physical methods- soil solarization, Hot water treatment, Incineration. Chemical control of plant diseases- fungicides- Different group of fungicides and antibiotics in plant disease management-Biological control of plant diseases - Plant products, Plant activators and Antiviral principles- method of application- plant protection appliances, Immunization - cross protection and host plant resistance – Types of resistance - vertical and horizontal resistance – resistance breeding and Resistant varieties. Mechanism of resistance- structural and bio chemical resistance in plants -Biotechnological approaches for crop disease management.

UNIT IV: Integrated Disease Management (IDM):
Introduction, history, importance, concepts, principles and tools of IDM. Economic importance of diseases and pest risk analysis. Calculation and dynamics of economic injury level and importance of economic threshold level.

Unit V: IDM module:
Development and validation of IDM module. Implementation and impact of IDM and IDM module for disease, Safety issues in pesticide uses. Political, social and legal implication of IDM. Case histories of important IDM programmes.

Lesson plan

1. Plant diseases – Abiotic, Biotic diseases - Classification based on mode of infection, multiplication of inoculum, spread, symptoms, occurrence & Distribution
2. Epidemiology - Disease triangle/ Disease Pyramid- Role of weather factors in plant disease development – Boom and bust cycle in disease outbreak
3. Survival and dispersal of plant pathogens and plant disease forecasting
4. Disease surveillance – Different methods – Surveillance report – Disease surveillance programme in Tamil Nadu
5. Assessment of Plant Diseases – Different methods – Measurement of disease growth rate by Area under disease progress curve (AUDPC)
6. Diagnosis of plant diseases- Seed health tests, Chemodiagnosis, serodiagnosis and molecular diagnosis
7. Avoidance- Role of cultural practices in plant disease management
8. Exclusion- Plant quarantine – domestic, International and Embargo- Phytosanitary certificate
9. Quarantine in India- Post Entry Quarantine- Exotic diseases introduced into India
10. Eradication of pathogens from seed and Planting materials – Eradication of diseased plants
11. Surgery and Rouging – Eradication of Alternate and Collateral host

12. Different methods of eradication- Mechanical, physical methods, chemical and Biological methods
13. Protection of crops from air borne, seed borne, soil borne and vector borne plant diseases- Physical methods- Soil solarization, Hot water treatment, Incineration
14. Chemical control – Fungicides-Ideal characters – Formulations and adjuvants
15. Sulphur and Copper group fungicides-classification- Phytotoxicity – mode of action and uses
16. Mercury fungicides- Heterocyclic nitrogen compounds- Organo tin, Quinone, Benzene and Miscellaneous compounds, mode of action and uses
17. **Mid Semester Examination**
18. Systemic fungicides including antibiotics-classification – mode of action -uses
19. New generation fungicides – Plant activators/SAR including chemicals
20. Methods of application of fungicides: seed treatment, foliar spray, soil drenching and special methods of application
21. Biological control- Definition – Mechanism of action- Mass production of *Trichoderma*, *Pseudomonas* and *Bacillus* – methods of application
22. Plant products- Antiviral principles-Preparation-Methods of application- Plant protection appliances
23. Immunization - cross protection and host plant resistance
24. Disease Resistance- Types- Vertical and Horizontal resistance - Resistance breeding – Methods of developing resistant varieties
25. Mechanism of resistance- structural and bio chemical resistance in plants
26. Biotechnological approaches for crop disease management – Tissue culture techniques
27. Introduction, history and importance of IDM
28. Concepts, principles and tools of IDM
29. Economic importance of diseases and pest risk analysis
30. Development and validation of IDM module
31. Implementation and impact of IDM and IDM module for disease
32. Safety issues in pesticide uses
33. Political, social and legal implication of IDM
34. Case histories of important IDM programmes

Practical Schedule

1. Survey and Assessment of important plant diseases
2. Diagnosis of Plant diseases: Tetrazolium test, Iodine test , ELISA test and Ooze test, paraquat test
3. Seed health tests for diagnosis of seed borne pathogens - dry seed examination, seed washing, Blotter tests
4. Classification and grouping of fungicides.
5. Preparation of Bordeaux mixture (1%) and Bordeaux paste (10%),
6. Calculation of spray fluid and methods of application of fungicides – Seed (wet and dry) Soil, Foliar and Post-harvest dipping.
7. Special methods of application: Swabbing, Acid delinting, Pseudostem injection, Capsule application
8. Special methods of application: Corm injection, Paring and prolinage, root feeding and trunk injection.
9. *In vitro* assay of fungicides against fungal pathogens
10. *In vitro* assay of biocontrol agents and their compatibility with agrochemicals
11. *Trichoderma viride* -Mass production and methods of application
12. *Pseudomons fluorescens* and *Bacillus subtilis* -Mass production & methods of

application

13. Visit to commercial biocontrol production unit /seed and pesticide testing laboratories
14. Preparation of leaf extracts, oil emulsion of neem and antiviral principles.
15. Tissue culture – Production of virus free plants through meristem tip culture technique.
16. Crop Dynamics (Agro-ecosystem) of a selected diseases
17. Plan & Assess preventive strategies (IDM module) and decision making

Course Outcome

CO1: Knowing the history, economic importance and principles of IDM

CO2: Having in depth knowledge in detection, diagnosis, economic injury level and economicthreshold level of plant diseases

CO3: Being updated with the different principles of plant disease management with ecologicalmanagement 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. Prakasam V, Raguchander T and Prabakar K, 2006. Applied Plant Pathology, A. E. Publications, Coimbatore.
2. Nene, Y.L. and Thapliyal, P.N. 2018. Fungicides in Plant Disease Control. Fourth edition. Medtech Publishers.
3. Dinakaran D, Arjunan G and Karthikeyan G. 2003. Biological control of Plant Diseases
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. Scientific Publishers

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

ANM 201 INTRODUCTORY NEMATOLOGY (1+0)

Learning objectives

- To introduce Agricultural Nematology and its scope
- To understand the morphology and anatomy of nematodes
- To understand the classification of plant parasitic nematodes
- To gain knowledge on different nematode pests in crops
- To gain knowledge on Integrated Nematode Management

Unit I: Nematodes – History and Morphology

Nematology – its history and development in India and abroad – Position of nematodes in animal kingdom – Economic importance of nematodes.

Unit II: Morphology and Anatomy

External morphology and internal anatomy of a typical nematode (alimentary, excretory, nervous, reproductive system and sense organs)

Unit III: Taxonomy

Taxonomy of important phytonematodes – classification of plant parasitic nematodes and classification based on feeding habits. Economically useful nematodes

Unit IV: Nematode damage

Symptoms of nematode damage – Association with other microorganisms (fungi, bacteria and virus) – Biology and ecology of important plant parasitic nematodes (Meloidogyne, Heterodera, Rotylenchulus, Tylenchulus and Radopholus)

Unit V: Nematode management

Principles of nematode management. Control measures of nematodes in agricultural crops. Integrated Nematode Management.

Theory Schedule

1. Introduction to Nematology
2. History of Nematology in India
3. Morphology and Anatomy of Nematodes
4. Anatomy: Inner Body Tube
5. Anatomy: Oesophageal glands
6. Male Reproductive System
7. Biology of Plant Parasitic Nematodes
8. Taxonomy of Plant Parasitic Nematodes
9. **Mid Semester Examination**
10. Ecological classification of plant parasitic nematodes
11. Identification of economically important plant nematodes
12. Symptoms Caused by Nematodes
13. Nematode pests of crops
14. Interaction of Nematodes with Micro-Organisms
15. Principles of nematode management
16. Different methods of Nematode Control
17. Biological Control and INM

Course Outcome

CO1: Gain knowledge on Agricultural Nematology and its scope
CO2: Gain knowledge on morphology and anatomy of nematodes
CO3: Gain knowledge on classification of plant parasitic nematodes
CO4: Gain knowledge on different nematode pests in crops
CO5: Gain knowledge on Integrated Nematode Management

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. Bhatti, D.S., R.K. Walia, 1992. Nematode pests of crops. CBS Publishers & Distributors. New Delhi.
2. Dasgupta. M.K. 1997. Phyto nematology. Nayaprakash, Calcutta.
3. Goodey, J.B., Technical Bulletin No. 2. 1963. Laboratory Methods for work with plant and soil nematodes – Ministry of Agriculture, Fisheries and Food, London, 72p.
4. Gopal Swarup and D.R. Dasgupta, 1986. Plant Parasitic Nematodes of India – Problems and Progress – ICAR, New Delhi, 576p.
5. Maggenti, A. 1981. General Nematology – Springer Verlag. Newyork Inc. 372p.

HOR 202 PRODUCTION TECHNOLOGY FOR ORNAMENTAL CROPS, MAPS AND LANDSCAPING (1+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: Landscaping

Importance and scope of ornamental crops landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers.

Unit II: Production technology of cut flower crops under protected conditions

Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions

Unit III: Production technology of flowers under open conditions and value addition in ornamental crops

Production technology of important cut flowers like gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Processing and value addition in ornamental crops.

Unit IV: Production technology of medicinal crops

Medicinal crops- importance and scope – current status - soil and climate – varieties – propagation– planting methods – nutrient, irrigation and organic practices – harvest – post-harvest handling – storage, packaging of Periwinkle, Asparagus, Aloe, Costus, Isabgol, Glory lily, extraction and value addition of medicinal crops.

Unit V: Production technology of aromatic crops

Aromatic crops - importance and scope – current status -- soil and climate – varieties – propagation– planting methods – nutrient, irrigation and organic practices – harvest – post-harvest handling – storage, packaging of Ocimum, Mint, Geranium, Citronella, Lemon grass, Palmarosa and Vetiver – Distillation of oil and value addition.

Practical

Identification of Ornamental plants. Nursery bed preparation and seed sowing. Training and pruning of Ornamental plants. Planning and layout of garden. Protected structures – care and maintenance. Intercultural operations in flowers. Harvesting and post-harvest handling of cut and loose flowers. Visit to commercial flower unit.

Medicinal and Aromatic Plants

Identification of Medicinal and Aromatic Plants- varieties-propagation-special practices - nutrient management, extraction and distillation of essential oil - Periwinkle, Asparagus, Aloe, Costus, Isabgol, Glory lily, Ocimum, Mint, Geranium, Citronella, Lemon grass, Palmarosa and Vetiver – visit to commercial medicinal and aromatic plants fields and processing units

Theory lecture schedule

1. Importance and scope of ornamental crops and landscaping.
2. Principles of landscaping
3. Landscape uses of trees, shrubs and climbers.
4. Production technology of cut rose under protected conditions
5. Production technology of gerbera and carnation under protected conditions
6. Production technology of lilium and orchids under protected conditions
7. Production technology of gladiolus and tuberose under open conditions
8. Production technology of chrysanthemum and marigold under open conditions
9. **Mid Semester Examination.**
10. Production technology of **jasmine** under open conditions.
11. Processing and value addition in ornamental crops.
12. Scope and Importance of medicinal & aromatic crops– current status - conservation methods
13. Production technology of Periwinkle, Asparagus and Aloe vera
14. Production technology of Costus, Isabgol and Glory lily

15. Production technology of Ocimum, Mint and Geranium
16. Production technology of Citronella, Lemon grass, Palmarosa and Vetiver
17. Processing and value addition in medicinal and aromatic plants.

Practical schedule

1. Identification, planting, care and maintenance of trees, shrubs and climbers used in garden
2. Identification of varieties in cut flowers under protected conditions.
3. Identification of varieties in flowers under open conditions.
4. Practices of nursery bed preparation, seed sowing in ornamental plants.
5. Training and pruning and intercultural operations in Ornamental plants
6. Planning and layout of garden.
7. Protected structures – care and maintenance.
8. Harvesting and post-harvest handling of cut and loose flowers.
9. Identification of medicinal and aromatic plants –economic parts
10. Propagation techniques, planting, cultural operations in Periwinkle, Asparagus and Aloe.
11. Propagation techniques, planting, cultural operations in Costus, Isabgol and poppy.
12. Propagation techniques, planting, cultural operations in Ocimum, Mint, Geranium
13. Propagation techniques, planting, cultural operations in lemon grass, palmarosa, vetiver and citronella
14. Extraction and distillation of medicinal & Aromatic crops.
15. Visit to commercial floriculture and floral oil extraction units
16. Visit to commercial medicinal and aromatic crops field and extraction unit.
17. **Practical Examination**

Course outcome

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

CO 2: The students will be able 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. Bhattacharjee, S.K and De L.C (2003) Advanced Commercial Floriculture Vol. (1) Aavishkar publishers, Distributors, Jaipur.
2. Bhattacharjee, S.K and De L.C (2005) Medicinal Herbs & Flowers, Aarishkar, Jaipur.
3. Bhattacharjee, S.K., 2004. Hand book of medicinal plants, Pointer publications, Jaipur.
4. Bose, T.K., Yadav, L.P., Pal. P., Parthasarathy, V.A., Das. P., 2003. Commercial flowers. Vol. I and II. Naya udyog, Kolkata-6.
5. Ravindrasharma (2004) Agro techniques of Medicinal plants. Daya publishing, New Delhi.

E- References

1. http://www.theflowerexport.com
2. http:// www.intuxford.tripod.com
3. http://www.webct.uark.edu
4. http://www.pubmed.com
5. http://www.bestgarden.net/

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 risk in 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 Vs 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, transport and 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 – theirmeaning 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; – role of contract farming in risk mitigation.

Practicals

Computation of marketable and marketed surplus of important commodities; study of price behavior over time for some selected commodities; construction of index numbers; visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc… to study their organization and functioning; application of principles of comparative advantage of international trade.

Lesson plan

Theory Schedule

1. Agricultural marketing: concepts and definitions of market, marketing, agriculturalmarketing. Classification and characteristics of agricultural markets.
2. Approaches 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 Vs traditional agricultural marketing systems producer's surplus – meaning and its types, 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, and 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 cost .
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 over space, 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 promotion and 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 itneeds. 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 commoditiesand 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. Acharya S.S. and Agarwal, N.L., 2011, Agricultural Marketing in India, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Jhingan, M.L., 2011. International Economics, Vrinda Publications (P) Ltd., New Delhi.
3. Acharya S.S. and Agarwal, N.L., 1994. Agricultural Prices–Analysis and Policy, Oxfordand IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Kahlon A. S. and S. D. Tyagi, 2000. Agricultural Price Policy in India - Allied PublishersPvt. 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%20marketing_EgEcon530.pdf

AEG 202 RENEWABLE ENERGY AND GREEN TECHNOLOGY (1+1)

THEORY

Unit I- Introduction to Renewable energy Sources

Energy crisis – classification of energy sources – renewable energy – significance – potential - achievements in India. Biomass – methods of energy conversion.

Unit-II Biochemical Energy Conversion

Biofuels – importance – biodiesel and bioethanol production method – flowchart – by products utilization. Biogas technology – classification - types - factors affecting biogas plants- alternate feedstocks – applications - biodigested slurry and enrichment.

Unit III – Thermochemical Energy Conversion

Briquetting –methods- advantages and disadvantages -combustion –definition- Improved chulhas – types – construction features - applications. Pyrolysis – methods for charcoal /biochar production- comparion of slow and fast pyrolysis. Gasification – chemistry – types – updraft gasifier -downdraft gasifier – working principles – operation and applications.

Unit IV – Solar Energy Conversion

Solar Energy – characteristics - types of radiation – solar constant-solar thermal devices – solar water heater – solar cooker – solar pond – solar distillation – working principles and applications. Solar PV systems – principle – solar lantern - water pumping. Solar

driers – natural and forced convection types – solar tunnel drier – working principles and operation.

Unit V- Wind and other Renewable Energy Sources

Wind – formations - Wind mills – types – horizontal and vertical axis – components – working principles – applications. Geothermal energy – wave energy – tidal energy – ocean energy – principle and operation - types – advantages and disadvantages

PRACTICAL

Familiarization with renewable energy gadgets. To study biogas plants, to study gasifier, to study the production process of biodiesel, to study briquetting machine, to study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, and solar fencing. To study solar cooker, to study solar drying system. To study solar distillation and solar pond.

Lecture Schedule

1. Energy crisis – renewable energy sources – significance – potential and achievements in India – energy requirements of agricultural and horticultural crops.
2. Biomass – methods of energy conversion – biochemical conversion methods – the rmochemical conversion methods.
3. Biofuels – importance – biodiesel and bioethanol production method – flowchart – by products utilization
4. Biogas technology – classification - types of biogas plants – KVIC and Deenabandhu model biogas plants – factors affecting biogas plants.
5. Alternate feedstocks for biogas production – applications of biogas cooking, lighting and engine operations - biodigested slurry and enrichment.
6. Briquetting – MED – VED – methods – need for briquetting - benefits of biomass briquettes.
7. Combustion – improved chulha – single pot – double pot – conventional chulha – biomass gas stove – constructional features – principles and applications.
8. Pyrolysis – methods for charcoal production –biochar production– comparison between slow and fast pyrolysis.
9. **Mid semester examination**
10. Gasification – chemistry – types – updraft gasifier – working principles operations – Application
11. Downdraft gasifier – working principles – operation and applications.
12. Solar energy – characteristics of solar radiation - types of radiation – solar constant
13. Solar thermal devices – solar water heater – solar cooker – solar pond – solar distillation – working principles and applications.
14. Solar PV systems – principle – solar lantern - water pumping applications.
15. Solar driers – natural and forced convection types – solar tunnel drier – working principles and operation.
16. Wind mills – types – horizontal and vertical axis – components – working principles – applications.
17. Energy from ocean, waves, tides. Geothermal energy sources – principles and operation.

Practical schedule

1. Basic principles of working of renewable energy gadgets
2. Experiments on biodiesel production
3. Experiments on bioethanol production process
4. Construction and working principle of KVIC biogas plant
5. Construction and working principle of deenbandhu biogas plant
6. Experiments on biogas applications
7. Experiments on briquetting technology
8. Performance evaluation of improved chulha
9. Evaluation of biochar production systems
10. Experiments on biooil production method
11. Performance evaluation of producer gas production system
12. Performance evaluation of solar dryers
13. Experiments on solar cookers and distillation systems
14. Performance evaluation of solar water heaters
15. Experiments on solar water pumping system
16. Performance assessment of solar street light and fencing
17. **Final practical examination**

References:

1. S. Pugalendhi, R. Shalini, J. Gitanjali and P. Subramanian. 2017. Introduction to Renewable Sources ofEnergy. TNAU, Coimbatore
2. G.D. Rai. 2012. Nonconventional Energy Sources. Khanna Publishers, New Delhi.
3. C.S. Solanki, 2009. Renewable Energy Technologies: A Practical Guide for Beginners. PHI LearningPvt. Ltd., New Delhi.
4. S. Rao and B.B. Parulekar. 2007. Energy Technology: Non-Conventional, Renewable and Conventional.Khanna Publishers, Naisarak, Delhi.
5. G.D. Rai. 1993. Solar Energy Utilisation. Khanna Publishers, New Delhi.

AMP 201 LIVESTOCK AND POULTRY MANAGEMENT (2+1*)*

Theory

Unit I: Introduction to Livestock Management

Significance of Livestock and Poultry in Indian Economy – Livestock and Poultry census – Different livestock development programs of Government of India and Tamil Nadu- Various systems of livestock production- extensive – semi intensive - intensive- mixed- Integrated and specialized farms.

Unit II: Dairy Cattle Management

Important White and Black cattle breeds-classification-indigenous and exotic – Breed characteristics – Breeding - Cross breeding- Upgrading - Economic traits of cattle – Culling - Estrus Cycle – Artificial Insemination – Introduction to Embryo transfer – Housing – Space requirement calf and adult stock – System and types of housing -

Feeding and Management of Calf, Heifer, Pregnant, Milch animal and working animals – Nutrition – Ration – Balanced Ration - Characteristics of ration and classification of feed and fodder –Total Mixed Ration –composition of concentrate mixture for different stage - Milking methods - Clean milk production – Factors affecting milk composition – Common diseases of cattle – classification – symptoms - preventing and control measures.

Unit III: Sheep and Goat Management

Breeds - Sheep and goat classification –– Economic traits - system of rearing - Housing Management – Floor space requirement - Care and Management of young and adult stock – Nutrition – Feed and fodders of Small ruminants – Flushing - Common diseases – prevention and control.

Unit IV: Management of Swine

Classification of breeds – Economic traits - Housing - Nutrition – creep feeding - Care and Management of Adult and Young Stock - Common disease- prevention and control.

Unit V: Poultry Management

Classification of breeds - Commercial Strains of broilers and layers – Housing – brooding – deep litter and cage system – care and Management of broilers and layers - Nutrition of Chick, grower, Layer and broiler – Incubation and Hatching of Eggs - Common Diseases - Control and prevention.

Practical

Study of external parts of Livestock - Identification of livestock and poultry-Tattooing-ear tags-wing and leg bands-Common restraining methods-Disbudding (or) Dehorning-Different methods of castration-Dentition- Study of type design of animal and poultry houses-Selection of dairy cow and work bullock-Determination of specific gravity, fat percentage and total solids of milk- Demonstration of cream separation, - Identification of feeds and fodder- Economics Dairy, Goat and Swine farming - Study of external parts of Fowl - Preparation of Brooder House - Brooder management-Identification of layer and non layer- Debeaking, delousing and deworming of poultry-Vaccination schedule for broiler and layer-Dressing of broiler chicken - Economics of Broiler and Layer Farming - Visit to a modern Dairy and commercial layer and broiler farms - Demonstration of incubator and setter.

Lecture schedule:

1. Significance of livestock and poultry in Indian economy-livestock and poultry census. Different livestock development programmes of Government of India and Tamil Nadu
2. Various systems of livestock production-extensive – semi intensive, intensive-mixed- integrated andspecialized farms.
3. Definition of breed-classification of indigenous white and black cattle-breed characteristics of Tamil Nadu cattle breeds and Indian breeds -Sindhi, Gir and Sahiwal.
4. Breed-characteristics of exotic cattle -Jersey and Holstein Friesian – Indian Buffaloes-Murrah, Surti andToda.
5. Breeding-cross breeding-upgrading-economic traits of cattle-culling importance and methods

6. Estrous cycle – signs of estrous - artificial insemination-merits and demerits- Principles and outline ofembryo transfer
7. Housing management-farm site selection and floor space requirement for calves, heifer, milch animal andwork bullocks.
8. Systems of housing-single row system-double row system- head to head and tail to tail-merits and demerits
9. Care and management of new born calf and heifers
10. Care and management of pregnant animal and lactating animals.
11. Care and management of dry cows and work bullock.
12. Nutrition-definition-ration-balanced ration-desirable characteristics of a ration. Classification of feed stuffs- concentrate and roughage-comparison, Total Mixed Ration
13. Model composition of concentrate mixture of young and adult stock-age wise feed and fodder requirement-Importance of green fodder.
14. Milking methods-clean milk production-factors affecting milk yield and composition
15. Diseases-classification-viral, bacterial and metabolic-general control and preventive measures.
16. Viral diseases-foot and mouth disease, bacterial diseases, anthrax, hemorrhagic septicemia- black quarter -metabolic- tympanites, acidosis, ketosis and milk fever
17. **Mid semester examination**
18. Sheep and goat farming-classification of breeds of Indian and exotic origin – economic traits.
19. Systems of rearing-housing management - type design- floor diagram-space requirement for adult andyoung stock.
20. Care and management of ram, ewe and lamb-nutrition- feeds and fodder for small ruminants.
21. Care and management of buck, doe and kid- nutrition- flushing.
22. Common ailments of sheep and goat-sheep pox-foot and mouth-blue tongue- PPR-enterotoxaemia-Ectoand endo parasites.
23. Swine husbandry –Common breeds of exotic origin-Large White Yorkshire, Landrace and Duroc -economic traits- housing of Swine.
24. Care and management of sow, boar and piglets-nutrition- creep feeding.
25. Disease prevention and control of swine diseases –hog cholera, foot and mouth, ecto and endo parasites.
26. Classification of breeds - commercial strains of layer and broiler.
27. Care and management of Chicks-brooder management.
28. Systems of housing- deep litter and cage system- floor space requirement-common litter material-littermanagement-merits and demerits.
29. Care and management of Grower and Layers- vaccination schedule.
30. Care and management of broilers-vaccination schedule.
31. Incubation and hatching of eggs.

32. Nutrition-feed formulation-composition of chick, grower, layer broiler- starter and Finisher mashes-Feed Conversion Ratio /dozen egg or kg of meat production.
33. Classification of disease –viral – bacterial - protozoan- causative organisms, symptoms and prevention – viraldiseases- Ranikhet – IBD-avian flu
34. Bacterial disease - E.coli – coryza – salmonellosis – protozoan – coccidiosis - casuative organism, symptoms and preventive measures. Management of dead birds and manure

Practical Schedule

1. Study of external parts of livestock
2. Identification of livestock and poultry
3. Common restraining methods of livestock
4. Disbudding, Dehorning, Castration and Dentition of livestock
5. Study of type design of animal and poultry houses
6. Selection of dairy cow and work bullock
7. Determination of specific gravity, fat %, total solids, solids not fat
8. Demonstration of cream separation
9. Identification of feed &fodder
10. Economics of dairy, goat and swine Farming
11. Study of external parts of fowl. Preparation of brooder house
12. Identification of layer and non- layer
13. Debeaking, delousing, deworming of poultry Vaccination schedule for broiler and layer
14. Demonstration of dressing of broiler. Economics of layer and broiler farming
15. Visit to a modern dairy and commercial layer and broiler farms
16. Demonstration of incubator and setter
17. **Practical examination**

Reference:

1. ICAR (2002) Hand of Animal Husbandry, ICAR, New Delhi.

EC ENT 202 URBAN ENTOMOLOGY (2+1)

EC SOL 203 AGROCHEMICALS (2+1)

Learning Objectives:

- The students are expected to gain both theoretical as well as practical knowledge onagrochemicals-their type and role in agriculture,
- The student learn the effect on environment, soil, human and animal health; management ofagrochemicals for sustainable agriculture
- Understand how more efficient use of agrochemicals can build and improve the health of thesoil
- 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

BenthiocarbFate 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 and copperoxychloride.
10. Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and useof 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 singlesuperphosphate.
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 Manufacturing of NPK complexes.
33. Fertilizer control order.
34. 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 and Fertilizers
3. Sree Ramulu, U.S. 1979. Chemistry of Insecticides and Fungicides – Oxford and IBHPublishing 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.

EC AGM 201 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 biofertilizersproduction and usage.
- To understand and develop skills about the production technology of biopesticides andbiofertilizers
- 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 ofbiopesticides. 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 and

cyanobacteria. 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. Dosageand 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-scopeand potential of biopesticides.

CO 2: They will acquire basic knowledge in mass production technology and quality control ofbiopesticides

CO 3: Students will gain knowledge on individual characteristics features of bacterial and fungalbiofertilizers.

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 andBiopesticides. Oxford Book Company, Jaipur, India.
4. Gupta R.P., AnuKalia and Shammi Kapoor 2007. Bioinoculants a step towards SustainableAgriculture, 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

AGR 211 EDUCATIONAL TOUR- I (0+1)

V SEMESTER

AGR 301 RAINFED AGRICULTURE AND WATERSHED MANAGEMENT (1+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 Dryland farming

Dryland farming - India and Tamil Nadu - Major crops of Dryland in India and Tamil Nadu - rainfed farming - Significance, Characteristics and constraints of dry farming in India - Distribution of Arid and semiarid regions in World, India and Tamil Nadu.

Unit – II Rainfall climatology

Rainfall climatology - Length of growing period - Drought - Definition - Types and effects of Drought on crop production - Mechanism of drought tolerance in plants - Drought management - Contingent crop planning - Mid season correction - Mulching - anti transpirants.

Unit – III Soil moisture conservation approaches

Soil moisture conservation approaches: agronomical, engineering and agrostological measures - In-situ water harvesting, storage and recycling - water harvesting - farm pond, percolation pond.

Unit – IV Integrated dry land technologies

Integrated dry land technologies - Mechanization - Resource management under constraint situation - Cost reduction strategies in crop production - Non-monetary inputs and low cost technologies.

Unit – V Watershed management

Watershed management - alternate land use system - Agro forestry systems - Role of institutions - government policies for promotion of dryland farming.

Practical

Zonation of Dry farming regions of Tamil Nadu, India and World - Characteristics of ACZs of Tamil Nadu and cropping pattern - Study of tools, implements and machineries for tillage, sowing and after cultivation - Rainfall analysis - working out economics - Sustainability Indices - working out LGP - Preparation of contingency crop plan for aberrant rainfall situations - Visit to watershed.

Lesson plan

Theory Schedule

1. Significance and scope of dry farming in India and history of dryland agriculture.
2. Dry farming and rainfed farming: Definition and Characteristics.
3. Distribution of arid and semi-arid regions in World, India and Tamil Nadu.
4. Major crops of dryland in India and Tamil Nadu.
5. Characteristics of dryland farming and major constraints for crop production.
6. Drought: definition, types and effects of drought on crop production.
7. Drought management strategies and contingent crop planning: mid season correction.
8. Mulching, anti transpirants, in-situ soil moisture conservation techniques and approaches.
9. **Mid-Semester Examination.**
10. Water harvesting, storage and recycling.
11. Integrated dryland technologies and farm mechanization.
12. Watershed: definition, principles, classification and management.
13. Mechanization in dryland farming.
14. Resource management under constraint situations for irrigated and rainfed farming.
15. Cost reduction strategies in crop production - cropping system, integrated farming system and dry farming.
16. Non-monetary inputs and lowcost technologies for crop production.
17. Alternate land use systems in dryland - role of institutions – policies.

Practical Schedule

1. Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.
2. Agroclimatic, Agro ecological zones and characteristics.
3. Zonation of dry farming regions of Tamil Nadu, India and World.
4. Characteristics of ACZs of Tamil Nadu and cropping pattern.
5. Cropping and farming systems in dryland.
6. Skill development in Seed hardening technique.
7. Input management and efficiency in dryland.
8. Soil erosion and soil conservation practices.
9. Water harvesting structures and their use.
10. Study of methods to reduce evaporation and transpiration.

11. Study of tools, implements, and machineries for tillage, sowing and after cultivation and assessing their efficiencies.
12. Indices in dry farming - working out LGP and planning for cropping system.
13. Drought management technologies in dryland agriculture.
14. Preparation of contingency crop plan for aberrant rainfall situations.
15. Alternate land use system and their merits.
16. Visit to watershed area to study the impact of various soil and moisture conservation methods.
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 oil seeds.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, New Delhi.
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

AGR 302 PRACTICAL CROP PRODUCTION - I (Kharif Crops) (0+1)

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 m^2. 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 and economics.

Practical Schedule

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 manuresand 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, levelingand 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 per student
17. **Practical examination**

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

Course Outcome

CO 1: To acquire skill in various agronomic practices that can bring improvedcrop yield.
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 matrix

	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 NaduAgricultural University, Coimbatore.
2. Rajendra Prasad. 2006. Text Book on Field Crop Production, Indian Council of Agrl. Research,New Delhi.
3. K Annadurai and B Chandrasekaran. 2009. A Text Book of Rice Science. Scientific Publishers.
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/.

GPB 301 CROP IMPROVEMENT - I (Kharif Crops) (1+1)

Learning objectives

- To impart knowledge about the origin, evolution and modes of reproduction for differentKharif crops.
- To impart knowledge about the floral biology, crossing techniques, objectives of breedingand wild species as donors for resistant traits.
- To impart knowledge about the Genetics and Genomic relationship of Yield and Qualitycharacters for different Kharif crops.
- To impart knowledge about the Biotic and Abiotic stress resistance breeding for differentKharif 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 - genebanks -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 oilseeds - 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, and 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 of hybrids 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 temperaturetolerant varieties in different crops.

Practicals

Observation of floral biology - Anthesis and Pollination - Selfing and crossing techniques- studyof 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 pollinated andvegetatively 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 ofFodder crops: Napier grass and Para grass, Fibre crops : Cotton
11. Centres of origin, distribution of species, wild relatives of Cash crops: Tobacco, Vegetable crops: Tomato, Brinjal, Chilli, And 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 breedingself 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 propagatedcrops.
16. Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea. 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, floralformula 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 and cowpea.
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 inSorghum and Redgram.
12. Study of field techniques for varietal seed production and hybrid seed production in Castorand 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 plantbreeding.
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 in CropPlants.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 PublishingCompany Ltd., New Delhi.
4. Phundn Singh, 2006. Essentials of Plant Breeding.KalyaniPublishers, New Delhi.
5. Singh,B.D. 2006. Plant Breeding: Principles and Methods. Kalyani Publishers, 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

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 precisionagriculture
- 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 II: 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 dataand their management in GIS. Global positioning system (GPS), components and its functions andtheir use in Precision Agriculture

Unit III: 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 scale effects, 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, concepts and techniques, components andits implications, issues, role and concerns in Indian agriculture.
2. Geo informatics- definitions and terminology, concepts, techniques and tools, their use inprecision agriculture.
3. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies.
4. GIS -components of GIS, Spatial data and their management ,Graphic representation of data- Vector /Raster- models-digitization.
5. 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.
6. Remote sensing- concepts – applications in agriculture images – sensor systems-satellites, types- NOAA satellites, GOES satellites, INSAT,IRS, SEASAT,OCEANSAT-1,IKONOS
7. 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
8. Global positioning Systems (GPS) - components, functions and applications.
9. **Mid Semester Examination**
10. Integration of Remote sensing and GIS -need for integration-applications
11. Soil fertility management- Soil Test crop response (STCR) studies, Crop SimulationModels and their uses for optimization of agricultural inputs.
12. Nanotechnology -introduction– history – terminologies – definitions—basic concepts,nano scale, nano dimension effects.
13. Nanoparticles, nano materials, nano structures – their properties,
14. Synthesis of nano particles – concepts, up - down and bottom-up approaches, methods – attrition, pyrolysis ,chemical synthesis – soil gel process . principles, physical
15. 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
16. 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.
17. 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 that surroundproduction 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

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. Kalyanipublisher, 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.

E-resources

1. https://agrilpu.blogspot.com
2. https://www.agrimly.in
3. http://bscagristudy.online

https://www.coursehero.com

ENT 301 PESTS OF FIELD CROPS AND STORED PRODUCES AND THEIR MANAGEMENT (1+1)

Learning objectives

- To gain knowledge on pests of cereals and millets
- To gain knowledge on pests of pulses and oilseeds
- To gain knowledge on pests of cotton and sugarcane
- To gain knowledge on pests of green manures and forage crops
- To gain knowledge on pests of stored products and non-insect pests

Theory

Unit I: Pests of Cereals and Millets

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of rice, wheat, maize, sorghum, cumbu, ragi, thenai. Integrated Pest Management - case studies in rice.

Unit II: Pests of Pulses and Oilseeds

Distribution, bionomics, symptoms of damage and management strategies of insects and non-insect pests of pulses (redgram, green gram, blackgram, bengalgram, cowpea.), groundnut, castor, gingelly, sunflower, safflower, jatropa, soybean and mustard. Integrated Pest Management - case studies in groundnut.

Unit III: Pests of Cotton and Sugarcane

Distribution, bionomics, symptoms of damage and management strategies of insects and non-insect pests of cotton and sugarcane. Integrated Pest Management - case studies in cotton.

Unit IV: Pests of Green Manures, Forage Crops, Stored Products and Non-insect Pests

Distribution, bionomics, symptoms of damage and management strategies of pests of green manures (sunnhemp, sesbania, daicha, glyricidia), forage crops (lucerne and subabul) and stored products. Rodents and birds of agricultural importance and their management. Locusts and their management.

Theory schedule

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of

1. Rice – Sucking pests
2. Rice – Borers and defoliators
3. Maize, sorghum and cumbu
4. Wheat, ragi and thenai
5. Redgram, bengalgram, blackgram, greengram and cowpea
6. Groundnut, gingelly and sunflower
7. Castor, soybean, safflower, jatropha and mustard

8. Cotton
9. Mid semester examination
10. Sugarcane
11. Green manures- sunnhemp, sesbania, daincha, lucerne, subabul and gliricidia
12. Role of physical, biological, mechanical and chemical factors in deterioration of grain
13. Stored product pests
14. Methods of grain storage and various methods of stored product pest management
15. Mites, slugs and snails, rodents and bird pests
16. Locusts and their management
17. Integrated Pest Management in rice and cotton

Practical schedule

Identification of symptoms of damage and life stages of pests of
1. Pests of rice (sucking pests)
2. Pests of rice (borers and defoliators)
3. Pests of maize, sorghum and cumbu
4. Pests of wheat, ragi and tenai
5. Pests of redgram and bengalgram
6. Pests blackgram, greengram and cowpea
7. Pests of groundnut, gingelly and sunflower
8. Pests of castor, soybean, safflower, jatropha and mustard
9. Pests of cotton (sucking pests)
10. Pests of cotton (bollworms and defoliators)
11. Pests of sugarcane
12. Pests of green manures-sunnhemp, sesbania, daincha, lucerne, subabul and gliricidia
13. Pests of stored products
14. Gadgets for management of stored product insects
15. Rodents and Birds pests in field and storage
16. Visit to FCI godown and farmer's fields
17. Final practical examination

Assignment

- Collection and submission of 50 pests of field crops
- Rearing of 15 insect pests

Course Outcome

CO1: Gain knowledge on pests of cereals and millets
CO2: Gain knowledge on pests of pulses and oilseeds
CO3: Gain knowledge on pests of cotton and sugarcane
CO4: Gain knowledge on pests of green manures and forage crops
CO5: Gain knowledge on pests of stored products and non-insect pests

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. Manisegaran, S. and R.P. Soundararajan. 2010. Pest Management in Field Crops- Principles and Practices. Agrobios, Jodhpur, India. 316p. {ISBN (10): 81-7754-321-0}
2. David, B.V. and V.V. Ramamurthy. 2011. Elements of Economic Entomology, Namrutha Publications, Chennai. 386 p. {ISBN: 978-81-921477-0-3}

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/

PAT 301 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT-I (2+1)

Learning objectives:

- To acquire knowledge on etiology, symptoms, epidemiology and management of diseases ofcereals and millets.
- To acquire knowledge on etiology, symptoms, epidemiology and management of diseases ofpulses and oilseed crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases of cashcrops.
- To learn about the etiology, symptoms, epidemiology and management of diseases of Fruitcrops and vegetable crops.
- To learn about the etiology, symptoms, epidemiology and management of diseases of spicesand 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 pigeonpea, urdbean, mungbean, soybean, cowpea, groundnut, sesame, castor, tobacco, mulberry, sugarbeet and jute.

Unit III - Diseases of Fruits

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

Unit IV: Diseases of vegetables

Etiology, symptoms, epidemiology and management of major diseases of tomato, brinjal, tomato, cruciferous vegetables, beans and sweet potato.

Unit V: Diseases of spices, plantation and flower crops

Etiology, symptoms, epidemiology and management of major diseases turmeric, ginger, cardamom, coconut, arecanut, tea, coffee, marigold, crossandra, chrysanthemum and post harvest diseases of fruits and vegetables.

Practical

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 managementof diseases of rice
3. Diseases of maize
4. Diseases of sorghum
5. Diseases of bajra and finger millet
6. Diseases of minor millets
7. Diseases of pigeonpea
8. Diseases of urdbean, mungbean
9. Diseases of soybean and cowpea
10. Diseases of groundnut
11. Diseases of sesame
12. Diseases of castor
13. Diseases of tobacco
14. Diseases of mulberry
15. Diseases of sugarbeet and jute
16. Diseases of banana
17. **Mid-semester Examination**
18. Diseases of mango
19. Diseases of papaya
20. Diseases of guava and pomegranate
21. Diseases of tomato
22. Diseases of brinjal
23. Diseases of okra
24. Diseases of cruciferous vegetables

25. Diseases of beans and sweet potato
26. Diseases of turmeric and ginger
27. Diseases of cardamom
28. Diseases of coconut and arecanut
29. Diseases of tea
30. Diseases of coffee
31. Diseases of rubber and cocoa
32. Diseases of marigold, crossandra and chrysanthemum
33. Post harvest diseases of vegetables
34. Post harvest diseases of 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, sesame and castor
7. Diseases of tobacco and mulberry
8. Diseases of banana
9. Diseases of mango
10. Diseases of papaya, guava and pomegrante
11. Field visit
12. Diseases of brinjal, tomato and okra
13. Diseases of cruciferous vegetables and beans
14. Diseases of turmeric, ginger and cardamom
15. Diseases of coconut, tea, coffee and rubber
16. Diseases of marigold, crossandra, chrysanthemum
17. Post harvest diseases of fruits and vegetables

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

Course Outcome

CO 1: Acquired knowledge of etiology, epidemiology, identifying and managing diseases of cereals 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 in vegetables

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

CO-PO Mapping matrix

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
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 HillEducation, 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 Hall IndiaLearning 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=139
5. https://www.appsnet.org/Publications/Brown_Ogle/33%20Postharvest%20diseases%20(L MC&GIJ).pdf

HOR 301 POSTHARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES (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 Pickle preparations.
- To familiarize the students to gain knowledge on conventional and modern packaging methods.

Theory

Unit I

Scope and Importance of postharvest technology of fruits and vegetables- factors responsible for postharvest losses – constraints –pre harvest factors affecting postharvest quality - postharvest operation – precooling, grading, cleaning, waxing on shelf life of fruits and vegetables.

Unit II

Physiological and biochemical changes occurring during maturity and ripening- Respiration and factors affecting respiration rate - role of ethylene in regulation of ripening.

Unit III

Packaging and storage of fruits and vegetables - heat, chilling and freezing injury - storage (ZECC, cold storage, CA, MA and hypobaric) - cold chain management for fruits and vegetables

Unit IV

Value addition concepts, principles and methods of preservation, intermediate moisture food –Jam, jelly, marmalade, preserve, candy- concepts and standards of fermented and non-fermented beverages. Tomato products – Concepts and Standards

Unit V

Drying and dehydration of fruits and vegetables, concepts and methods, osmotic drying. Canning-concepts-processing of canned products-spoilage and prevention. Packaging of products –quality standards- GMP, HACCP, FSSAI, Codex alimentrarius and ISO certification.

Practical

Pre harvest operations to improve postharvest shelf life - assessment of maturity indices and harvest criteria of fruits and vegetables-different types of packaging for shelf life extension- of chilling and freezing injury in vegetables and fruits- estimation of ethylene evolution in fruit crops- Identification of postharvest diseases and disorders- Postharvest machineries -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 –physio-chemical and sensory evaluation. Visit to cold storage / packaging unit -visit to processing unit/ industry.

Theory schedule

1. Scope and importance of postharvest technology of fruits and vegetables
2. Factors responsible for post-harvest losses.
3. Pre-harvest factors affecting postharvest life of fruits and vegetables
4. Physiological and biochemical changes during maturity and ripening
5. Respiration and ripening and the factors affecting the ripening of fruits and vegetables
6. Role of ethylene in ripening of fruits and vegetables
7. Pre-harvest operations to extend shelf life of fruits and vegetable crops
8. Postharvest handling of the produce (washing, fungicide treatment, precooling,

grading, sorting waxing and Nano coating)

9. **Mid -semester examination**
10. Importance of packaging, types of packaging and packaging materials.
11. Methods of storage of fruits and vegetables *viz.* , Zero energy cool chamber, cold storage, controlled atmosphere, modified atmosphere and hypobaric storage and management of cold chain for export of high value fruits and vegetables
12. Principles and methods of preservation of fruits and vegetables
13. Preservation and value addition of fruits viz. , jam, jelly, marmalade, preserve and candy
14. Concepts and standards in fermented and non-fermented beverages from fruits and vegetables
15. Drying, dehydration and osmotic dehydration of fruits and vegetables- concepts and methods
16. Canning of fruits and vegetables- concepts-processing of canned products-spoilage and prevention
17. Packaging of products and standards in value addition of fruits and vegetables viz., GMP, HACCP, FSSAI, Codex alimentrarius and ISO certification.

Practical Schedule

1. Pre-harvest operations to improve post-harvest shelf life of fruits and vegetable crops
2. Assessment of maturity indices and harvest criteria for fruits and vegetable crops
3. Methods of packaging in fruits and vegetables
4. Identification and causes of chilling and freezing injury in vegetables and fruits
5. Estimations of ethylene evolution in fruit crops
6. Identification of postharvest diseases and disorders of fruits and vegetable crops
7. Postharvest machineries for fruits and vegetables crops
8. Postharvest handling of the produce (washing, fungicide treatment, grading, sorting, precooling, waxing and Nano coating).
9. Preparation of jam/Jelly and quality evaluation of products
10. Preparation of RTS, nectar, squash and quality evaluation of products
11. Processing of dried and dehydrated fruits and vegetables
12. Preparation of fruit bar and candy and quality evaluation of products
13. Preparation of tomato products
14. Processing of canned fruits and vegetables
15. Quality evaluation of products –physico-chemical and sensory evaluation.
16. Visit to processing unit/ industry and cold storage / packaging unit
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 horticultural crops.

CO3: The students will get familiarized with the storage and value addition of horticultural crops

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

Reference

- Adel A. Kader. 2002. Post-Harvest Technology of Horticultural Crops. University of California Agrl. And Natural Resources Publication.
- Ashwani. S. and Goel. 2007. Post-harvest management and value addition. Daya publishing house, Delhi.

E-References

www.fao.org/inpho
www.postharvest.ucdavis.edu
www.postharvest.ifas.ufl.edu
www.postharvest.com.au

AEC 301 AGRIBUSINESS 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 levels of managementfor the farm graduates
- To use the knowledge and skill gained for starting new agribusiness and managing thebusiness
- 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 of Agribusiness (input, farm and product sectors).
2. Agribusiness Management - Distinctive features of Agribusiness - Importance of Agribusiness 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 PublicLimited - Cooperatives.
5. Management functions: Planning – Definition – Types of plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, Rules, Programmes, Budget). Steps in planning – Characteristivs of sound plan. Objectives of 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, Networth analysis and cash flow analysis.Marketing management: meaning, definition – market segmentation, targeting andpositioning – 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. **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-PO Mapping Matrix

	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 SerialPublishing House, New Delhi.
2. Broadway, A.C. and Broadway, Arif, A.2002. Kalyani Publishers, New Delhi.
3. Prasad, L.M., 2005. Principles and Practices of Management, Sultan Chand and SonsEducational Publishers, New Delhi.
4. Philip Kotler, Kevin L.K, Swee H.A, Chin T.T, Siew M.L, 2018. Marketing Management: AnAsian Perspective, Pearson Education Ltd, UK.
5. Gittinger, J.P., 1982. Economic analysis of agricultural projects. The John Hopkins UniversityPress, 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

AEC 302 INTELLECTUAL PROPERTY RIGHTS (1+0)

Learning objectives

- To provide knowledge to students about basic concepts of Intellectual Property Rights
- To explain its relevance and importance in WTO and Agriculture
- To know the composition of IPR
- To understand the protection of plant varieties and farmers rights
- To study the biological diversity acts

Theory

Unit 1: Introduction of 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, industrialdesign, 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 data base.

Unit 4: Protection of Plant varieties (PPV &FR)

Origin, history including a brief introduction to UPOV for protection of plant varieties, protectionof plant varieties under UPOV and PPV & FR Act of India , Plant Breeders rights, registration of plant varieties under PPV & FR Act 2001, breeders, researcher and farmers 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, accessand 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 ofpatent.
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
16. Food and Agriculture (ITPGRFA), Indian Biological Diversity Act, 2002 and its salientfeatures, access and benefit sharing.
17. Research collaborations in agriculture and role of IPR in protecting public instituteinventions.

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 Act of India

CO5: Know the features of biological diversity and benefit sharing

CO-PO Mapping Matrix

	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
2. Learning Private Limited, New Delhi.
3. Acharya, N.K, Textbook of Intellectual Property Rights, 2002. Asia Law House, Hyderabad.
4. Keith, E. Maskus, 2000. Intellectual Property Rights in Global Economy, Institute forInternational Economics.
5. Jennewein, Klaus,2004, Intellectual Property Management, Springer Verlag ,US
6. Ganguli P., 2001. Intelectual Property Rights: Unleashing Knowledge Economy, Mc Grawhill.

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

EXT 301 - COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT (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, type's oflistening, barriers in listening & Note Taking, Oralpresentation skills: impromptu presentation & extempore presentation, Effective Public Speaking.

Unit III: Group discussion & Techniques

Group discussion: Procedure, principles, purpose, advantages & disadvantages, Small group discussion techniques: Panel. Symposium, buzz session, syndicate, conference, seminars, workshop, debate and lecture. Writing of technical articles, field diary & labrecord, 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 of personality type's analysis of attitude & student feedback, Management games, Simulation exercise - time management, conflict management & Stress management. Creativity, acquisitionof 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 communication skills: 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 & bibliographicprocedures

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
14. Time management: Importance & role in personality development & time managementTechniques
15. Conflict management: Meaning. Concept, causes of conflict & managing conflicts
16. Stress management: Meaning, definition, management of stress and current stream ofthoughts.

Practical Schedule

1. Simulation exercise for non- verbal communication& students feedback
2. Listening & note taking & student feed back
3. Exercise on reading & comprehension & studentsfeedback
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 Publishers Delhi
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

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- Pie Graphs Graphical Representation – Frequency histogram, Frequency polygon, frequency curve andogives.

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 andDemerits. Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation

Unit III: Probability Distribution and Bivariate Analysis

Introduction to Probability—Events, Sample Space, Definition of Probability, Addition and Multiplication Theorem (without proof). Binomial Distribution, Poisson distribution. Normal Distribution (Concepts only) Introduction to Correlation: Definition, Scatter Diagram, Types of correlation, Properties - Karl Pearson's correlation coefficient. Regression – definition – fitting of two simple linear regressionequation – 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: student's 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, Frequencypolygon, 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 andMultiplication 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 NullHypotheses)
13. Small sample tests: student's 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 variances and 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 ungrouped data
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, correlation andregression

CO5: Practical exposure to basic design of experiments

CO - PO Mapping Matrix

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

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, BS Publications,Hyderabad.
3. Dhamu. K. P and K. Ramamoorthy. 2007. Statistical Methods. Agrobios (India), Jodhpur.
4. Hand Book of Agricultural Statistics, C h a n d e l SRS, Achal Prakashan Mandirpublications, 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/

EC PAT 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 about 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, suppressive and 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 by resident and introduced antagonists.

Unit IV

Commercial production of antagonists. Antagonists available in market. Quality control systemof 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 vitro antagonism – assay of competitive saprophytic ability, antibiotics production, siderophores production– isolation of mychorriza and establishing its biocontrol potentiality – compatibilityof 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. **Practical Examination**

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. ICARPublications. 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.

EC GPB 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 anddemand.

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 notificationsystems 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 enhancement techniques – PPV & FRAct and IPR issues in commercial plant breeding.

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 cross pollinatedcrops.
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 two linesystems.
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 seedproduction.
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 to become 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 andPractices.Springer, Boston, MA.
2. Hayward, M.D., N.O. Bosemark, I. Romagosa and M. Cerezo. 1993. Plant Breeding Principlesand Prospects. Springer, Dordrecht.
3. Singh, B.D. 2009. Plant Breeding – Principles and Methods. Kalyani Publishers, New Delhi.

4. George Acquabah. 2012. Principles of Plant and Breeding, John Wiley and Sons, New Delhi.
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

EC HOR 302- HI-TECH HORTICULTURE (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, micropropagation 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 fertilizerscheduling, Leaf Nutrient analysis, nutrient deficiency symptoms and its remedy, water soluble fertilizers-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, Size and 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-
7. Advantages of Protected cultivation,
8. Various chambers.
9. Climate control - methods and techniques.
10. Micro irrigation systems and its components.
11. HDP, UHDP, Meadow Orcharding.
12. EC & PH based fertilizer scheduling
13. Water soluble fertilizers.
14. Weed management and weed mat.
15. Hydroponics and Aeroponics
16. Precision horticulture, Principles
17. **Mid semester Examination**
18. Concepts of precision horticulture
19. Remote sensing and Robotics
20. Geographical Information System (GIS) and its application.
21. Differential Geo-positioning System (DGPS).
22. Variable Rate applicator (VRA).
23. Role of IOT in Horticulture crops
24. Role of AI in Horticulture crops
25. Precision equipment's, computers and robotics in precision farming.
26. Precision farming technology for Horticultural crops.
27. Mechanized seed sowing and grafting

28. Pruning equipment's, trimmers, brush cutters and mowers
29. Modern spraying methods-Drones, aerial sprayers.
30. Mechanization in harvesting -Fruit harvester, Tree shaker.
31. Computerized Graders-Size and colour sensors.
32. Mechanized packaging units.
33. Bottling and corking methods.
34. 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 Nursery Technologies.
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 management andcrop 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 DistributingCompany.
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-

VI SEMESTER

AGR 303 PRINCIPLES OF ORGANIC FARMING (1+1)

Learning objectives

- Aims at incurring knowledge on various aspects of organic farming and its importance in present world scenario and its impact on environment and soil health
- To develop skills on managing farm resource and improving nutritional standards forbetterment of health
- To study the organic nutrient and weed and pest management
- To occurring knowledge about ITK
- Students will get exposure on innovative organic farm products and certification

Theory

Unit - I: Components and Principles of Organic farming

Definition - Scope - principles and concepts - history of organic farming - global scenario - biodiversity: importance and measure to preserve biodiversity - pre requisites for Organic farming- Soil organic carbon: status and improvement strategies.

Unit - II: Organic sources of Nutrients

Organic sources of nutrients - manures and other inputs - on farm and off farm sources - organic waste recycling - methods - Soil and crop management - inter cropping, crop rotation, green manures, cover crops, mulching - bio fertilizers.

Unit - III: Non - Chemical weed and Pest disease management

Non-chemical weed management methods: preventive, physical, cultural, mechanical and biological measures - Bio-intensive pest and disease management.

Unit - IV: Indigenous Technical Knowledge (ITK)

Indigenous Technical Knowledge (ITK) in organic agriculture - scientific rationale - soil, nutrient, weed, water, management - prospects and problems in organic farming.

Unit - V: Certification of label

Organic certification - NPOP guidelines - Certification agencies in India - crop production standards - Quality considerations - labeling and accreditation process - marketing and export opportunities.

Lesson plan

Theory Schedule

1. Organic farming; definition - prospects - principles and concepts - History and genesis of organic farming in World and India: Present status in World, India and Tamil Nadu.
2. Introduction to bio - diversity; importance and measures to preserve bio - diversity.
3. Pre-requisites and basic steps for organic farming; conversation to organic farming - planning and processes in practices - IFS approach - Integration of animal components.
4. Organic carbon; status and improvement strategies - conservative tillage systems.
5. Sources of organic manures - plant, animal and microbial origin - on - farm resources; FYM, green manures, crop residues, poultry manure, sheep and goat manures, biogas slurry and vermicompost.
6. Off-farm resources; coir pith, press mud, oilcakes, flyash, bio compost, minerals, bone meal, bio fertilizers, traditional preparations.
7. Organic waste recycling methods and techniques - composting, vermicomposting, in situ composting - system approach.
8. Soil and crop management in organic farming; Inter cropping and companion planting, crop rotation green manures and cover crops, mulching.
9. **Mid semester examination**
10. Weeds - Ecology - habitat management of weeds - Non - chemical weed management methods; preventive, physical, cultural, use of tools and implements and biological measures - good crop husbandry practices.
11. Integrated pest and diseases management - bio control agents, bio rational pesticides; minerals, botanicals, soaps, trap crops, bird perches, and traditional preparations - sanitation.
12. Indigenous technical knowledge (ITK) in organic agriculture - rationale and principles - general, indigenous practices for soil, nutrient, weed, water pest and disease management in farming - ITK's in farmers practice.
13. Benefits and problems in organic farming.
14. Organic farming; Promotional activities; role of government and NGO's - action plan - policy considerations.
15. Economic evaluation of organic production systems - cost - benefit analysis and comparison with conventional systems.
16. Organic certification - procedures - certification agencies in India - labeling, marketing and export opportunities.
17. Crop production standards - NPOP guidelines - principles, recommendations and standards - Quality considerations - assessment methods - premium and export opportunities.

Practical Schedule:

1. Resource inventory of organic farm- Soil sampling and analysis for organic carbon and pesticide residues / contaminants.
2. Raising of green manures (Sunnhemp / Daincha / Fodder cowpea).
3. Incorporation of green manure - seed treatment and raising of field crop (Rice / Maize / Cowpea / Cotton / Gingelly).
4. Hands on practice on preparatory cultivation; soil and water conservation methods.
5. Hands on experience on recycling techniques; bio-composting and vermicomposting.
6. Quantification of nutrients from organic sources and application of manures and bio-fertilizers.
7. Exposure visits to an organic farm to learn ITK based preparations.
8. Organic crop production and weed management.
9. Skill development in composting farm residues.
10. Organic crop production and pest management.
11. Exposure visits to bio-control agent (Pseudomonas, Trichoderma etc.,) production units.
12. Organic crop production and diseases management.
13. Skill development in vermicompost preparation.
14. Hands on training on grading, packaging and post-harvest management.
15. Exposure visit to organic market out lets.
16. Exposure visits to organic certification agencies / Directorate of Organic Certification, Tamil Nadu.
17. **Practical Examination**

Course outcome:

CO 1: To gain the information and acquire practical knowledge on organic farming
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 production
CO 5: To know about labeling in organic agriculture

CO-PO Mapping Matrix

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

References:

1. Dahama, A.K.2009. Organic farming for sustainable agriculture, Agrobros publishers.

2. SP. Palaniappan and K Annadurai. 2008. Organic Farming: Theory and Practice. 2008.
3. Scientific Publishers. Panda, S.C. 2012.
4. Principles and Practices of Organic Farming. Agribios (India), Jodhpur. Gehlot, D. 2010.
5. Organic Farming- Components and Management. Agribios (India), Jodhpur. Dushyant Gehlot. 2010. Organic farming: Components and management.Agrobios (India), Jodhpur. Ranjan Kumar Biswas.2014.
6. Organic farming in India. N.D.Publishers. New Delhi.

E-Resources

1. www.ifoam.org
2. www.apeda.org
3. www.cowindia.org
4. www.ncof.org
5. www.earthfooda.co.uk,
6. www.newfarm.org/training

AGR 304 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 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 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 nutrient and weeds - Recording growth, yield attributes and yield

- Harvesting, threshing and cleaning the produce - Cost of cultivation and economics.

Practical Schedule

1. Selection of field for ID crop cultivation
2. Acquiring skill in seed treatment practices
3. Study and practice of main field preparation for ID crop
4. Practicing of application of manures and fertilizers for ID crop
5. Practicing sowing of ID crop/ exposure to mechanized sowing
6. Acquiring skill in pre-emergence application of herbicides
7. Estimation of plant population and acquiring skill in gap filling and thinning
8. Observation on nutritional deficiency symptoms and corrective measures
9. Mid-semester examination
10. Study of weeds and weed management in ID crop/ exposure to mechanized weeder
11. Recording growth parameters and assessing dry matter production
12. Study of water management practices for ID crop
13. Observation of insect pests and diseases and their management
14. Estimation of yield and yield parameters in ID crop
15. Harvesting, threshing and cleaning of the produce/ exposure to mechanized harvesting andthreshing.
16. Preparation of balance sheet including cost of cultivation and net returns per student
17. **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 maize
CO 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. RamaPublishing 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.

GPB 303 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 biotechnologicalapproaches.

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-gene banks-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 ofBerseem 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 different rabi 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, Bulkand Single Seed Descent methods

10. Study of field techniques for varietal seed production and hybrid seed production inSunflower, Chickpea
11. Study of field techniques for varietal seed production and hybrid seed production inRapeseed 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, Publishing Agency, New Delhi.
3. Phundan Singh, 2006. Essentials of Plant Breeding. . Kalyani Publishers, New Delhi.
4. Poehlman, J.M. and Borthakur, D. 1995. Breeding Asian Field Crops. Oxford and IBH, Publishing Co., New Delhi.
5. 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

ENT 302 PESTS OF HORTICULTURAL CROPS AND STORED PRODUCES AND THEIR MANAGEMENT (1+1)

Learning objectives

- To gain knowledge on pests of vegetables
- To gain knowledge on pests of fruit crops
- To gain knowledge on pests of tuber crops
- To gain knowledge on pests of spices and plantation crops
- To gain knowledge on pests of flower crops, medicinal plants, lawn and stored products

Theory

Unit I: Pests of Vegetable Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non-insect pests of Brinjal, Bhendi, Tomato, Chillies, Onion, Garlic, Moringa, Amaranthus Crucifers, Cucurbits.

Unit II: Pests of Fruit Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non-insect pests of Mango, Citrus, Banana, Guava, Grapevine, Sapota, Pomegranate, Papaya, Aonla, Apple, Pine apple, Custard apple and Jack

Unit III: Pests of Tuber Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non-insect pests of Potato, Sweet potato, Tapioca, Yam and Colocasia

Unit IV: Pests of Spices and Plantation Crops

Distribution, bionomics, symptoms of damage and management strategies of insect and non-insect pests of Coconut, Arecanut, Tea, Coffee, Cashew, Cocoa, Betelvine, Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind

Unit V: Pests of Flower Crops, Medicinal Plants, Lawn and Stored products

Distribution, bionomics, symptoms of damage and management strategies of insect and non-insect pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna, Periwinkle, Lawn and Stored products.

Practical

Identification of symptoms of damage and life stages of important pests of different horticultural crops: vegetables, fruits, spices, tubers, plantation crops, flower crops, medicinal plants, lawn and stored products.

Theory lecture schedule

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of

1. Brinjal, Bhendi and Tomato
2. Chillies, Onion, Garlic, Moringa and Amaranthus
3. Crucifers and Cucurbits
4. Mango and Citrus
5. Banana, Guava, Grapevine and Sapota
6. Pomegranate, Papaya and Aonla
7. Apple, Pine apple, Custard apple and Jack
8. Potato, Sweet potato, Tapioca, Yam and Colocasia
9. **Midsemester examination**
10. Coconut and Arecanut
11. Tea and Coffee
12. Cashew, Cocoa and Betelvine
13. Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind
14. Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Cut flowers
15. Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna, Periwinkle and lawn
16. Stored product pests
17. Strategies for stored product pest management

Practical schedule

Identification of symptoms of damage and life stages of important pests

1. Pests of Brinjal, Bhendi and Tomato
2. Pests of Chillies, Onion, Garlic, Moringa and Amaranthus
3. Pests of Crucifers and Cucurbits
4. Pests of Mango, Citrus and Sapota
5. Pests of Banana, Grapevine and Guava
6. Pests of Pomegranate, Aonla, Papaya
7. Pests of Jack, Pine apple, Custard apple, Ber and Apple
8. Pests of Potato, Sweet potato, Tapioca, Yam and Colocasia
9. Pests of Coconut and Arecanut
10. Pests of Coffee and Tea
11. Pests of Cashew, Cocoa and Betelvine
12. Pests of Turmeric, Ginger and Coriander
13. Pests of Cardamom, Pepper, Curry leaf and Tamarind
14. Pests of Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose and Cut flowers
15. Pests of Gloriosa, Coleus, Phyllanthus, Aswagantha, Senna and Periwinkle
16. Pests of Lawn and stored products
17. **Final Practical Examination**

Assignment

- Collection and submission of 50 pests of horticultural crops
- Rearing of 15 insect pests

Course Outcome

CO1: Gain knowledge on pests of vegetables
CO2: Gain knowledge on pests of fruit crops
CO3: Gain knowledge on pests of tuber crops
CO4: Gain knowledge on pests of spices and plantation crops
CO5: Gain knowledge on pests of flower crops, medicinal plants, lawn and stored products

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. Muthukrishnan, N., N. Ganapathy, R. Nalini and R. Rajendran. 2005. Pest Management in Horticultural Crops. New Madura Publishers, Madurai. 325p. {ISBN: 81-902832-0-0}

2. Nair, M.R.G.K. 1986. Insects and mites of crops in India. Publications and Information Division, ICAR, New Delhi. 408p.

3. Parvatha Reddy. 2010. Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops. Scientific Publishers, Jodhpur. 384p. {ISBN: 978-81-7233-628-8}

4. David, B.V. and V.V. Ramamurthy.2011. Elements of Economic Entomology. Namrutha Publications, Chennai. 386 p. {ISBN: 978-81-921477-0-3}

5. Butani, D.K. and M.G. Jotwani.2013. Insects in Vegetables. Daya Publishing House, New Delhi. 356p.

6. Regupathy, A. and R. Ayyasamy. 2013. A Guide on Crop Pests. Namrutha Publications, Chennai.368p. {ISBN: 978-81-921477-1-0}

E - Resources

1. http://agritech.tnau.ac.in/horticulture/horti_plantprotection_pest.html
2. http://www.nbaii.res.in/insect pests/pestsearch.php?cropname=Mango
3. http:www.ncipm.org.in/databases.htm
4. ipm.illinois.edu

PAT 303 DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT-II (2+1)

Learning objectives

- To acquaint with the symptoms, etiology, disease cycle and management of diseases of wheat 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 of important diseases of fruits and vegetables crops.
- To know about the symptoms, etiology, disease cycle and management practices of important diseases of spices and plantation crops.
- To know about the symptoms, etiology, disease cycle and management practices of important diseases of flower crops.

Theory

Unit-I Diseases of Cereals and Pulses

Symptoms, etiology, disease cycle and management of wheat, chickpea and lentil.

Unit-II Diseases of Oilseeds and Cash crops

Symptoms, etiology, disease cycle and management of sunflower, safflower, mustard, sugarcane and cotton.

Unit-III Diseases of Fruits and Vegetable crops

Symptoms, etiology, disease cycle and management of citrus, grapevine, sapota, jack, pineapple, ber, apple, pear, peach, plum, strawberry, cucurbits, potato, peas, carrot, beetroot, cassava, colacasia and yam.

Unit-IV Diseases of Spices, Plantation and Flower crops

Symptoms, etiology, disease cycle and management of chillies, onion, garlic, coriander, pepper, betelvine, vanilla, rose, jasmine, tube rose, carnation, lillium and orchids.

Unit-V Diseases of Medicinal crops and Mushroom cultivation

Medicinal crops: gloriosa, coleus, stevia and aloe; **Mushroom cultivation:** Importance of mushroom and cultivation of button mushroom, oyster mushroom, milky mushroom and paddy straw mushroom- pest and diseases of mushroom

PRACTICAL

Study of symptoms and host parasite relationship of the important diseases of wheat, chick pea, lentil, sunflower , mustard , cotton, sugarcane, citrus, grapevine, sapota , jackfruit , pineapple, ber, apple , peach, plum , strawberry, cucurbits , potato , peas , beet root , cassava, colacasia, yam, chillies, ginger, onion, garlic, coriander, cardamom, black pepper, vanilla, rose, Jasmine, marigold, crossandra, chrysanthemum, tube rose , carnation, lillium , orchids, gloriosa, coleus, stevia and aloe and cultivation of button mushroom, oyster mushroom, milky mushroom and paddy straw mushroom.

Lesson plan

Theory schedule

Etiology, symptoms, mode of spread, survival, epidemiology and integrated management of

1. Diseases of wheat
2. Diseases of chickpea and lentil
3. Diseases of sunflower, safflower and mustard
4. Diseases of cotton
5. Diseases of sugarcane
6. Diseases of citrus
7. Diseases of grapevine
8. Diseases of sapota and jack
9. Diseases of pineapple and ber
10. Diseases of apple
11. Diseases of pear, peach, plum and strawberry
12. Diseases of cucurbits
13. Diseases of potato – I (fungal diseases)
14. Diseases of potato – I (bacterial and viral diseases)
15. Diseases of peas, carrot and beet root
16. Diseases of cassava, colacasia and yam
17. **Mid-Semester Examination**
18. Diseases of chilli
19. Diseases of onion
20. Diseases of garlic and coriander
21. Diseases of pepper
22. Diseases of betelvine and vanilla
23. Diseases of rose
24. Diseases of jasmine
25. Diseases of tube rose and carnation
26. Diseases of lillium and orchids
27. Diseases of gloriosa and coleus
28. Diseases of stevia and aloe
29. Diseases of stored grains and their management
30. Mushroom edible and poisonous mushroom – importance of mushroom
31. Cultivation of button mushroom and oyster mushroom
32. Cultivation of milky mushroom and paddy straw mushroom
33. Pests of mushroom
34. Diseases of mushroom

Practical Schedule

Study of symptoms and host-parasite relationship of:

1. Diseases of wheat
2. Diseases of chickpea, lentil, sunflower, safflower and mustard
3. Diseases of cotton

4. Diseases of sugarcane
5. Diseases of citrus and grapevine
6. Diseases of sapota, jack, pineapple and ber
7. Diseases of apple, pear, peach, plum and strawberry
8. Diseases of potato, peas, carrot and beet root
9. Diseases of cucurbits, cassava, colacasia and yam.
10. Field visit/exposure visit to hilly fruits, vegetables and plantation crops / mushroom visit
11. Diseases of chilli, onion and garlic
12. Diseases of pepper, betelvine and coriander
13. Diseases of rose, jasmine
14. Diseases of tube rose, carnation, lillium and orchids
15. Diseases of gloriosa, coleus, stevia and aloe
16. Cultivation of oyster, milky and paddy straw mushroom cultivation
17. **Practical Examination**

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	PO1	PO2	PO3	PO4	PO5	PO6
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 HillEducation, New Delhi.
4. Devappa V., Dinesh Singh and Jahagirdar S. 2017. Diseases of Ornamental Crops. Today andTomorrows 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 Hall IndiaLearning 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

ABT 301 PLANT BIOTECHNOLOGY (1+1)

Theory

Unit I Basics of Plant Tissue Culture

Plant tissue culture: Concepts, history and scope - Media and Culture Conditions - Sterilization techniques- Regeneration methods - morphogenesis, organogenesis and embryogenesis - culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture; anther and pollen culture; ovule and embryo culture

Unit II Applied Plant Tissue Culture

Micropropagation - banana and ornamental plants; National certification and Quality management of TC plants- Applications of organ culture - Meristem tip culture (virus free plants) and anther - secondary metabolite production- invitro germplasm conservation

Unit III Basic Molecular Biology

Genome organization- prokaryotes vs eukaryotes- Central dogma of life - Structure of nucleic acids - DNA replication, aminoacids and their classification- genetic codes- transcription, - basic techniques in molecular biology-Blotting techniques- Polymerase chain reaction- DNA sequencing methods.

Unit IV Recombinant DNA Technology and Genetic Transformation

DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases - Different types of vectors: plasmids, phagemids, cosmids, BAC - Construction of recombinant DNA molecules- Bacterial transformation Agrobacterium mediated method - Detection of GMOs **–** regulations and biosafety.

Unit V Molecular Marker Technology and Molecular Breeding

DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, and SNPs - DNA fingerprinting of crop varieties – Development of mapping populations- linkage and QTL analysis - Applications of Plant Genomics and genome databases

Practicals

Biotech Laboratory organization, safety regulations – basics of reagents and solution preparation- Plant tissue culture media preparation- shoot tip culture (rose) - Meristem culture (tapioca)- Micro propagation of banana - Callus culture – Culturing of E. coli and determination of growth curve-Isolation of bacterial plasmid DNA- Restriction Digestion and Ligation- Competent cell preparation and Bacterial transformation – confirmation of transformation through colony screening - DNA extraction from plants- Quantification of DNA and quality check through Agarose gel electrophoresis - Molecular marker analysis- DNA fingerprinting using RAPD/SSR markers - NTSys- analysis of diversity in crop plants- Visit to tissue culture units /biotech labs in seed industry/Bt cotton field/tissue culture banana fields

Lecture Schedule

1. Plant tissue culture: Concepts, history and scope
2. Media and Culture Conditions and Sterilization techniques
   Regeneration methods - morphogenesis, organogenesis and embryogenesis
3. Culture types - callus culture and cell suspension culture; shoot tip and meristem tip culture Anther and pollen culture; ovule and embryo culture
4. Micropropagation - banana and ornamental plants
5. Protoplast isolation and fusion- somaclonal variation-synthetic seeds
6. Secondary metabolite production, invitro germplasm conservation
7. Genome organization- prokaryotes vs eukaryotes
8. Central dogma of life - Structure of nucleic acids
9. **Mid semester Examination**
10. DNA replication- Mechanism
11. Transcription and Post transcriptional processing - RNA splicing
    Translation - Amino acids and their classification, genetic codes and protein synthesis
12. Blotting techniques and Polymerase chain reaction
13. DNA sequencing methods DNA manipulation enzymes: Polymerases, restriction endonucleases and ligases
14. Different types of vectors: plasmids, phagemids, cosmids, BAC
15. DNA markers - hybridization based markers (RFLP) - PCR based markers: RAPD, SSR, AFLP, andSNPs
16. Linkage and QTL analysis
17. Applications of Plant Genomics and genome databases

Practical schedule

1. Biotech Laboratory: Organization and Safety Regulations 21 Basics of Reagents and Solution Preparation
2. Plant Tissue Culture Media Preparation
3. Shoot Tip Culture of Rose
4. Meristem Tip Culture of Tapioca25 Micropropagation of Banana
5. Callus Culture
6. Isolation of Bacterial Plasmid DNA
7. Restriction Digestion and Ligation

8. Competent Cell Preparation and Bacterial Transformation
9. Confirmation of Transformation through Colony Screening
10. Genomic DNA Extraction from Plants
11. Quantification of DNA
12. Quality Check through Agarose Gel Electrophoresis
13. DNA Fingerprinting using PCR
14. NTSys- Analysis of Diversity in Crop Plants
15. Visit to Tissue Culture Units /Biotech Lab in Seed Industry/Bt Cotton Field
16. Lateral Flow StripAssay
17. **Final Practical Examination**

Reference:

1. Chawla. H S. 2009. **Introduction to Plant Biotechnology (3/e).** CRC Press , London. 730 PISBN 9781578086368
2. Razdan M K, 2014. Introduction to plant Tissue Culture 2nd Edn. Science Publishers, inc. USA.
3. Singh, B. D. 2012. Plant Biotechnology. Kalyani publishers, Ludhiana
4. Tomar, R. S. , Parakhia, M. V. , Patel, S. V. and Golakia, B. A. , 2010. Molecular markers and Plant Biotechnology,New Publishers, New Delhi.
5. Xu, Y 2010. **Molecular Plant Breeding.** International Maize and Wheat ImprovementCentre (CIMMYT). 752 Pages

E- Reference

1. http://www. isaaa. org/india/- Briefs
2. http://www. nal. usda. gov.
3. http://www. agbiotechnet. com.
4. http://www. agbioworld. org
5. http://www. cropgen. org.
6. http://www. agbiosafety. unl. edu/.

AEC 303 AGRICULTURAL FINANCE BANKING AND COOPERATION (1+1)

Learning 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 higherfinancing 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 ofproject 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 creditstructure: 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 - dear money 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): objectives and 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 – Fixationof 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. Techno economic 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, 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

credit system, policies for revitalizing co-operative credit.

14. Negotiable instruments: meaning, importance and types. Credit gap: factors influencing credit gap.
15. Central bank: RBI – functions, credit control – objectives and methods: CRR, SLR and reporate. 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 – handknowledge of their management, schemes and procedures.
6. Visit to District Central Co-operative Bank (DCCB) to study its role, functions andprocedures for availing loan – Fixation of scale of finance.
7. Guest lecture on Role and functions of commercial bank and lead bank / NABARD and its role 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. Preparation and analysis of income statement – 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 productsand 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 Outcome

CO1: To understand the functions of various institutions involved in farm financing.

CO2: To know the principles of credit, 5c's, 3R's and 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

availablefor the benefits of famers.

CO5: To know the different crop insurance schemes in India

CO-PO Mapping 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. Farm Finance for Development, Oxford and IBH, New Delhi.
2. Subba Reddy, S and P.Raghu Ram, 2011. Agricultural Finance and Management, Oxfordand IBH, 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. and R.D.Saxen, 1973. Cooperation in India, Kitab Mahal, Allahabad.
5. Patnaik, V.E. and A.K. Roy. 1988. Cooperation and Cooperative Management, KalyaniPublishers, 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_A gricultural_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/

EXT 302 ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION(1+1)

Learning objectives

- To familiarize the students to understand with key concepts and processes in entrepreneurship 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 firms andeconomic 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, Impact of 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 of entrepreneurial activities, SWOT analysis of selected enterprise. Analysis of leadership and organizational skills. Study about Entrepreneurship development Institute, Business Communication and Negotiation Studyabout Successful Enterprise and characteristics of Successful Entrepreneurs

Lecture Plan

Theory schedule

1. Concept of Entrepreneur, Entrepreneurship, Agri- Entrepreneurship, concept, need, scopeand 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, Governmentpolicies and programmes and schemes

5. EDP Process-Stages
6. Developing organizational skills (controlling, supervision, monitoring and evaluation)
7. Achievement Motivation, Problem solving skills
8. **Mid Semester Examination**
9. Managing an enterprise, SWOT analysis, Time Management
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 andmanagement.
16. Supply Chain Management- Meaning, definition, process, advantages and disadvantages
17. Total quality Management: Meaning, definition, process and advantages and currentstream of thoughts.

Practicals 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
CO5	1	0	0	0	0	3

Referenes

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, KalyaniPublisher, New Delhi.
3. Indu Grover 2008 Handbook on Empowerment & Entrepreneurship, Agrotech Public Academy
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 andCommunication 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

AEG 301 PROTECTED CULTIVATION AND SECONDARY AGRICULTURE (1+1)

Learning Objectives

- To learn about the precession horticulture.
- To learn about the various structure of protected cultivation.
- To make them familiarize with the cultivation and application practices of horticultural crops in protected cultivation.
- To provide knowledge on secondary agriculture practices.

THEORY

Unit I: Introduction to Protected Cultivation and Green houses

Protected cultivation – need, advantages and limitations – present status. Green house technology – Introduction – Types of greenhouses- Plant response to greenhouse environment.

Unit II Design of Greenhouses

Planning and design of greenhouses - Design criteria of green house for cooling and heating purposes - Green house equipment - Materials for construction of greenhouses - Irrigation systems used in greenhouses.

Unit III Applications of Greenhouses

Typical applications - Passive solar greenhouse - Hot air greenhouse heating systems - Greenhouse drying - Cost estimation and economic analysis.

Unit IV: Engineering Properties of Food Materials

Physical properties- size-shape, Aero-hydro dynamic properties, thermal properties- specific heat- thermal conductivity- thermal diffusivity, and their application in PHT equipment design and operation.

Unit V: Drying and Dehydration

Drying and dehydration, Moisture determination- direct method and indirect method of moisture determination, drying rate curves- constant rate period, CMC- Falling rate period, EMC, Drying methods- contact type dryers- convective type dryer- radiation dryer, commercial grain dryer -deep bed dryer-flat bed dryer- tray dryer-fluidized bed dryer. -Recirculatory dryer- solar dryer.

Unit VI: Material Handling

Introduction- selection of material handling machines, Belt conveyor- belt conveyor idlers- idler spacing- belt material- belt tension, Bucket conveyor- head section-Boot section-elevator legs- elevator belts- bucket drive mechanism. Screw conveyor- Details - various shapes screw trough- capacity – horse power, pneumatic conveyor – advantages and limitations.

PRACTICAL

Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Performance evaluation of screen cleaner. Determination of Moisture content of various grains by direct method and indirect method. Determination of capacity of belt conveyor and bucket conveyor.

THEORY LECTURE SCHEDULE

1. Introduction to protected cultivation – need, advantages and limitations and present status – protected cultivation for horticultural crops
2. Green house technology – Definition, History and evolution – Advantages and limitations
3. Types of greenhouses – based on shape, cost, utility and cladding materials
4. Plant response to greenhouse environment – Sunlight, Temperature, Relative Humidity, Carbon dioxide enrichment – Soil / media
5. Planning and design of greenhouses – Criteria for site selection – orientation – structural design - Design criteria of green house for cooling and heating purposes

6. Equipment and components of a Greenhouse – Summer cooling and winter cooling, natural ventilation and forced ventilation
7. Materials for construction of greenhouses – Wood, iron, glass, polyethylene film
8. Irrigation systems in greenhouses - Rules of watering, hand watering, perimeter watering, overhead sprinklers, boom watering and drip irrigation
9. **Mid semester examination.**
10. Typical applications of greenhouses – passive solar greenhouse, hot air greenhouse heating system and green house drying- Cost estimation and economic analysis.
11. Physical properties – size- shape- sphericity- density- specific gravity, Aero-hydrodynamic properties – Terminal velocity- drag coefficient
12. Thermal properties- specific heat- thermal conductivity- thermal diffusivity, Application of Engineering properties of cereals, pulses and oilseeds in PHT equipment design and operation.
13. Moisture measurement, direct method and indirect method of moisture measurements, Drying and dehydration, Drying theory, drying rate curves- constant rate period, CMC- Falling rate period , EMC.
14. Various drying method, contact type dryers- convective type dryer- radiation dryer
15. Commercial grain dryer- deep bed dryer-flat bed dryer- tray dryer-fluidized bed dryer, recirculatory dryer- solar dryer.
16. Material handling equipment-introduction, screw conveyor working principle, and selection.
17. Bucket elevator- head section-Boot section-elevator legs- elevator belts- bucket drive mechanism- Screw conveyor and pneumatic conveyor working principle and selection

PRACTICAL SCHEDULE

1. Study of different types of greenhouses based on shape, etc.
2. Measurement of weather data in green houses
3. Computing the rate of air exchange in an active summer and winter cooling systems
4. Experiment on determination of shape and size of the cereal grains
5. Experiment on determination of bulk density and porosity of biomaterials
6. Determination of Moisture content of various grains by direct method
7. Determination of Moisture content of various grains by indirect method
8. Experiment on determination of terminal velocity of different grains
9. Performance evaluation of available screen cleaner
10. Performance evaluation of fluidized bed dryer
11. Performance evaluation of tray dryer
12. Determination of Capacity of a belt conveyor and its performance evaluation
13. Determination of Capacity of a bucket conveyor and its performance evaluation
14. Field visit to greenhouse
15. Visit to Horticulture Research Station, Udhagamandalam
16. Visit to food modern rice mill
17. **Final Practical Examination**

Course outcome

CO 1: The students will be able to understand the present status protected cultivation.
CO 2: The students will be able to understand the green house technology and its type.
CO3: The students will be to diagnose the climate change and its demand of agriculture crops.
CO4: The students will be able to practice the physical and thermal properties in bio materials.
CO5: The students will be able to practice the grain drying and dehydration.

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

REFERNCES

1. Singh Brahma and Balraj Singh., 2014. Advances in Protected Cultivation, New India Publishing Company.
2. Greenhouse Management for Horticulture crops – S.Prasad&U.Kumar., 2013. AGROBIOS (INDIA).
3. Greenhouse Management for Horticulture crops – Sandhya Sharaf., 2012. Oxford Book Company.
4. Greenhouse for Homeowners and Gardeners - John W. Bartok, Jr., 2000. NRAES
5. Greenhouse Engineering - Robert A. Aldrich and John W. Bartok, Jr., 1994. NRAES
6. Sahay K.M and Singh K .K. Unit operations of agricultural processing. Vikas Publishing house Pvt. Ltd. New Delhi.

COM 301 AGRO-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 and PowerPoint. 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 of File, Edit and Format menus. MS-EXCEL: Data Presentation, Data presentation, interpretation and graph creation - Statistical analysis, mathematical expressions with MS-EXCEL MSOLCESS: Database, concepts and types - Uses of DBMS in Agriculture; creating database.

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, Agriculture Expert 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 ofComputers.
3. Memory concepts
4. Operating System, Types of operating system.
5. Booting sequence of operating system, DOS, Windows, UNIX, and VIRUS.
6. MS Office word, Creating, Editing, Formatting a document and saving a document.
7. MS Excel Data Presentation, Data presentation,
8. Interpretation and graph creation.
9. **Mid Semester Examination**
10. MS Access Concepts of Database, Creating Database.
11. Internet - World Wide Web (WWW)
12. Programming Languages, Computer programming languages.
13. E-Agriculture.
14. ICT in Agriculture.
15. IT application.
16. Smartphone Apps in Agriculture.

17. Applications in Agriculture.

Practical schedule

1. Study of Computer Components and accessories– Booting of Computer and its Shut Down.
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, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars, Creating Folders, COPY and PASTE functions and File Management.
5. MS-WORD – creating, editing and presenting a scientific Document.
6. MS-POWER POINT – creating, editing and presenting a scientific Document.
7. MS-EXCEL: Creating a spreadsheet, writing expressions, Entering formula expression through the formula tool bar and use of inbuilt statistical, mathematical functions.
8. MS-EXCEL: creating graphs, analysis of scientific data-Data analysis-t-test, Regression, ANOVA.
9. MSOLCESS: Creating Database, preparing queries and reports.
10. MSOLCESS: 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.
17. **Practical Examination**

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 toinformation 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.

ECAGR 305 SYSTEM SIMULATION AND AGRO-ADVISORY (AGR) (2+1)

EC EXT 303 AGRICULTURAL JOURNALISM (2+1)

Learning objectives

- To acquaint the students with the concepts of Journalism and how to write the agricultural news 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 Farmjournalism

Theory

Unit I: Introduction to Journalism

Journalism: Definition, meaning, functions & its role. Different types of Journalismwith 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 andmagazines, 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 offeature story, -principle-Parts, Writing news stories withdifferent types 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 video programme

Unit V: Social media and digital journalism

Role of social media in farmjournalism, Editing of news story, Farm advertisement and roleand 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.

Practicals

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 Art Works 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 PrintMedia 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 Journalismwith 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 Farm Journalist
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. **Mid Semester Examination**
10. Newspapers and magazines asa communication media 10.Characteristics, kinds

and functions of newspapers and magazines11.Characteristics of newspaperand magazine readers

11. Form, content, style and language of newspapers andmagazines 13.Parts of newspapers and magazines
12. News story-Meaning, definition purpose, writing of news story, principles and parts15.Agricultural story-Types- success story, feature story,news story
13. Feature story-Meaning, definition, purpose, writing offeature story, -principle-Parts
14. Writing news stories withdifferent types of leads
15. Photo journalism, meaning, role and its importance in transfer oftechnology 20.Use of art works, graphs, charts,maps in Agricultural Journalism 21.Writing attractive captions
16. Layout of Agricultural News
17. Readability, meaning, definition, concept and Measurement 24.Writing of radio script for delivering of radio talk 25.Writing of Story Board forTelevision and video programme26.Role of social media in farmjournalism
18. Editing of news story
19. Farm advertisement and roleand its importance in Agricultural Journalism 29.Proof Reading
20. 30. Digital Journalism- concept, definition, scope and significance 31.Digital Journalism - components and principles
21. Photo journalism elements and techniques 33.Difference between traditional and e-journalism
22. 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 Office
13. Visit to Electronic Media office
14. Preparation of interview schedule to study the farmer preference towards mass media15.Designing a programme on interview with farmer
16. Preparation of short film
17. Designing cover page for farm magazine

Course Outcome

CO 1: Describe the concepts of Journalism, agricultural journalism& characteristics of agricultural 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..AstralInternational (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

EC AEC 304 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 agriculturalsector.
- 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 Project Management

Introduction -Project definition-Project characteristics-Project performance dimensions Project 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 analysis Undiscounted 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.

Unit II: Human Resource in Project Management

Project organization design Human resource management-Role management-Team building Communication-Motivation-Decision making leadership Appraisal -Social CostBenefit 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 anduncertainties.

Unit V: 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 an 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-Team building
15. Communication-Motivation-Decision making leadership
16. Appraisal -Social Cost Benefit Analysis (SCBA)
17. **Mid SemesterExamination**
18. Project management techniques-Bar Charts -Gantt Chart-Milestone Chart
19. Networks - Activity-on-Arrow (AOA)- Activity-on-Node (AON)- Programme Evaluationand 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 -Monitoring and progressreporting-Monitoring techniques
30. Indicatorsformonitoring-Typesofmonitoring-Monitoringriskanduncertainties

31. Evaluation–Definition,introduction,features,importance-Comparisonofappraisal,monitoringandevaluation
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. Development skills in identification of projects
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 an 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 down payments.
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-PO Mapping Matrix

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

References

1. Chalmers, James, 2002. How to Manage Project, Jaico Publishing House, and Mumbai.
2. Chandra, Prasanna, 1995. Projects: Preparation, Appraisal, , Tata Mc

Graw Hill Publications, New Delhi.
3. Gittinger, Price J.1982. Economics Analysis of Agricultural Projects, the John HopkinsUniversity Press, London.
4. Goel, B.B. 1989.Project Management, Deep & Deep Publications, New Delhi.
5. LittleI.M.D. and Mirelees, J.A. 1974. Project Appraisal and Planning for DevelopingCountries, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

E-resources

1. https://lecturenotes.in/subject/171/project-management
2. https://collegetutor.net/notes/Fundamentals_of_Project_Management_ LPU_note s_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%20Manage mentt200813.pdf

VII SEMESTER

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 durationof 20 weeks with a weightage of 0+20 credit hours in two parts. The Rural Horticultural Work Experience (RHWE) helps the students primarily to understand the rural situations, status of agricultural technologies adopted by the farmers to prioritize the farmer's problems and to develop skills & attitude of working with farm families for overall development in rural area. The timings for RHWE 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. The students 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 depending upon 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. Thestudents 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.

RAWE & AIA - Rural Agricultural Work Experience and Agro-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**

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

S. 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.	Floriculture and Landscape interventions	1 week
7.	Food Processing and Storage interventions	1 week
8.	Extension and Transfer of Technology activities	1 week

RAWE Component –II

Agri-Industrial Attachment

- Students shall be placed in Agro and Cottage industries and Commodities Boards for 03weeks.
- 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 industry staff
- 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 the University.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**	

EXT 411 EDUCATIONAL TOUR – II **

Visit to important National and International institutes related to agriculture, horticulture, forestryand allied fields in various regions of the country. Exposure to varied agro-climatic zones, crops grown, cultivation practices, socio-economic and cultural features of the farming community in differentparts of the country.

VIII SEMESTER

The Experiential Learning Programme (ELP) /Hands on Training (HOT)

Experiential Learning Programme /Hands on Training (HOT) helps the student to develop competence, capability, capacity building, acquiring skills, expertise, and confidence to start their own enterprise and turn job creators instead of job seekers.
The main objectives of ELP 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 Programme (ELP) 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 ELP. Allotment of ELP amongst students to different modules should be done strictly on the basis of merit at theend of sixth semester.

EXPERIENTIAL LEARINING PROGRAMME (ELP)

S. No.	Department	Code	Courses	Credit
1.	Agronomy	EL AGR 401	Agriculture Waste Management	10(0+10)
2.	Agronomy	EL AGR 402	Organic Production Technology	10(0+10)
3.	Genetics and Plant Breeding	EL GPB 401	Seed production Technology	10(0+10)
4.	Soil Science Agricultural Chemistry	EL SOL 401	Soil, Plant, Water and Seed Testing	10(0+10)
5.	Entomology	EL ENT 401	Commercial Beekeeping	10(0+10)
6.	Entomology	EL ENT 402	Commercial Sericulture	10(0+10)
7.	Plant Pathology	EL PAT 401	Mushroom Cultivation Technology	10(0+10)
8.	Agricultural Microbiology	EL AGM 401	Bio-inoculant Production Technology	10(0+10)
9.	Horticulture	EL HOR 401	Commercial Horticulture	10(0+10)
10.	Horticulture	EL HOR 402	Floriculture and Landscaping	10(0+10)
11.	Agricultural Engineering	EL AEG 401	Food Processing Technology	10(0+10)
12.	Animal Production	EL AMP 401	Poultry Production Technology	10(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 and another staff member appointed as examiner by the Head of the Department. The final examination 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**