

**COURSE  
STRUCTURE  
AND DETAILED  
SYLLABUS**

**B.Sc. (Hons.)  
AGRICULTURE**

**A 4 YEAR PROGRAM**

(APPLICABLE FOR THE BATCHES ADMITTED FROM 2021-2022)



**ANURAG  
UNIVERSITY**

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- Artificial Intelligence & Machine Learning
- Computer Science & Engineering
- Computer Science & Systems Engineering
- Computer Science with Data Science
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**PG courses are available in all Engineering departments.**

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- Pharm.D.
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- B.B.A.
- M.B.A.

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- B.Sc. (Hons.) Agriculture

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# **ACADEMIC REGULATIONS (AU-R21)**

## **For the B. Sc. (Hons) Agriculture Program**



**With effect from the Academic year 2021-22**

**School of Agricultural Sciences**

**ANURAG UNIVERSITY**

Ghatkesar (M), Medchal-Malkajgiri (Dist), Hyderabad, Telangana  
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25<sup>th</sup> November 2021



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## **Academic Regulations for B.Sc. (Hons) Agriculture with effect from the Academic Year 2021-22**

### **1. Title and Duration of the Program**

- 1.1 These regulations shall be called ANURAG University, School of Agricultural Sciences - UG Regulations 'Governing the Undergraduate programs of study leading to the award of B.Sc. (Hons) Agriculture Degree in the Faculty of Agriculture. These regulations come into force with effect from the academic year 2021-22.
- 1.2 The B.Sc. (Hons) Agriculture program duration shall be four academic years divided into eight semesters and each semester having 16 weeks of instruction.
- 1.3 Students admitted to the B.Sc. (Hons) Agriculture program shall have to complete the course of study within a maximum time frame of 6 years (4+2 years) from the year of admission. Relaxation sought on genuine grounds will be referred to the Board of Management.

### **2. Admission Procedure**

- 2.1 A candidate for admission into the B.Sc. (Hons) Agriculture program must have passed the Intermediate Examination of the Board of Intermediate Education, Government of Telangana/any other state with Physics, Chemistry and Biology as optional courses or the ranks obtained in the Anurag University common entrance test/ EAMCET/ ICAR central or state level tests or any other test prescribed by the University.
- 2.2 Rule of Reservation: As per the Section 33 of the Telangana State Private Universities Act No. 11 of 2018 and Rule 10 of the G.O.Ms. No.26 [Higher Education (UE.1) Department], Dt. 20-08-2019.

### **3. Program of Study and Code**

<b>Program</b>	<b>Code</b>
B.Sc. (Hons) Agriculture Sciences	01

#### 4. Credits

- 4.1 The details of the credits, courses and syllabi of the under graduate courses shall be as prescribed by the Academic Council from time to time.
- 4.2 The following is the credit allocation table.

Course	Credits
1 Hour Lecture (L) per week	1
1 Hour Tutorial (T) per week	1
1 Hour Practical (P) per week	0.5
2 Hour Practical (P) per week	1
Mini project	02
Comprehensive Viva Voce	02
Seminar	02
Project	20

#### 5. Distribution and Weightage of Marks

- 5.1 The performance of a student in a semester shall be evaluated course-wise for a maximum of 100 marks in each theory and practical course. In addition, industry-oriented mini-project, seminar, comprehensive viva-voce and project work shall be evaluated for 100 marks each (Annexure-I).
- 5.2 The distribution of marks for Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE) along with the minimum pass percentage shall be as follows:

Course	Continuous Internal Evaluation (CIE)	Semester End Examination (SEE)	*Min. Pass Percentage in (SEE)	*Min. Pass Percentage (CIE+SEE)
Theory	50	50	50	50
Laboratory/Practical	50	50	50	50
Industry-Oriented mini-Project, to be taken up during the vacation after III Year II Semester examinations and evaluated in 4th year I Sem.	0	100	50	50
Comprehensive viva-voce in IV Year II Semester	0	100	50	50
Project Work	50	50	50	50



5.3 For theory courses the distribution shall be 50 marks for Continuous Internal Evaluation (CIE) and 50 marks for the Semester End Examination (SEE).

#### **5.4 Continuous Internal Evaluation (CIE):**

5.4.1 The CIE has two components namely, a) Mid Term Examinations, b) Assignment/Seminars/Projects/Group Activities and c) Practicals.

##### **a. Midterm examination:**

For theory subjects, there shall be two midterm examinations and two assignments as a part of continuous internal evaluation. Each midterm examination shall be conducted for the duration of 90 minutes and the question paper consists of Part-A (Objective type) and Part-B (Long Answers).

The First midterm examination shall be conducted for 2.5 units of syllabus at the end of 8 weeks of instruction and Second midterm examination shall be conducted for remaining 2.5 units at the end of 16 weeks of instruction.

There shall be an optional third midterm examination during the preparation cum practical examinations period subject to the following conditions:

i. Interested students have to register for the third mid examination by paying the prescribed registration fee.

b. Third midterm examination covers entire semester syllabus carrying 30 marks in theory with practical courses and 40 marks for theory courses.

##### **Assignment / Seminars / Projects / Group Activities:**

The Assignment/Seminars/Projects/Group Activities should be submitted before the conduct of the second midterm examination.

5.4.2 The average of best two midterm examinations shall be taken as the final marks secured by each candidate.

#### **5.5 Semester End Examinations (SEE):**

5.5.1 The semester end examination will be conducted for 50 marks which consist of two parts viz., i). Part-A for 20 marks, ii). Part –B for 30 marks.

5.5.2 Part-A is compulsory.

5.5.3 Part-B consists of five questions covering one question (may contain sub-questions) from each unit of the syllabus carrying 6 marks each.

For each question there will be an “either” “or” choice (that means there will be two questions from each unit and the student should have to answer any one of them).-

- 5.5.4 For courses with only practicals, there shall be a continuous internal evaluation during a semester for 50 marks and Semester end practical external examination carries 50 marks.
- 5.5.5 The practical end semester examination shall be conducted with an external examiner along with one internal examiner. The external examiner shall be appointed by the Dean-Examinations from the list of panel of examiners approved by the Vice- Chancellor.
- 5.5.6 **Industry-oriented mini-Project:** There shall be an industry- oriented mini-Project, to be taken up during the vacation after III Year II Semester examinations. However, the mini project and its report shall be evaluated in IV Year I Semester. The industry oriented mini project shall be submitted in report form and should be presented before the committee, which shall be evaluated for 100 marks. The committee consists of the head of the department, the supervisor of mini project and a senior faculty member of the department nominated by the Dean-School of Agriculture. There shall be no CIE marks for industry oriented mini project.
- 5.5.7 **Seminar presentation:** There shall be a seminar presentation in IV Year II Semester. For the seminar, the student shall collect the information on a specialized topic and prepare a technical report, showing his/her understanding of the topic, and submit it to the Department. It shall be evaluated by the committee consisting of Head of the Department, seminar Supervisor and faculty member nominated by the Dean-School of Agriculture. The seminar report shall be evaluated as CIE for 100 marks.

- 5.5.8 **Comprehensive viva-voce:** There shall be a comprehensive viva-voce in IV Year II Semester. The comprehensive viva-voce shall be conducted by a committee consisting of the Head of the Department and two senior faculty members of the department. The comprehensive viva-voce is intended to assess the students understanding of the courses he studied during the program. The comprehensive viva-voce is evaluated as SEE for 100 marks.
- 5.5.9 **Project Work:** Out of a total of 100 marks for the project work, 50 marks shall be for CIE and 50 marks for the SEE. The SEE shall be based on the two seminars given by each student on the topic of his/her interest. The SEE (viva-voce) shall be conducted by the committee consists of an (i) External examiner appointed by Dean - Examinations on the recommendation of Chairperson, BOS, (ii) Head of the department, (iii) Supervisor of the project and (iv) Senior faculty member of the department. The evaluation of project work shall be conducted at the end of the IV Year II Semester.
- 5.5.10 The Laboratory marks and the CIE awarded by the faculty are subject to scrutiny and scaling by the University whenever/wherever necessary. In such cases, the CIE and laboratory marks awarded by the teacher will be referred to a committee consisting of Chairperson BOS/HOD, Dean-Examinations/COE and subject expert. The committee will arrive at a scaling factor and the marks will be scaled accordingly. The recommendations of the committee are submitted to the Vice-Chancellor and his decision is final. The laboratory records and internal test papers shall be preserved for a period of two years or as specified by the University from time to time.
- 5.6 Candidates shall be permitted to apply for recounting/revaluation of SEE scripts within the stipulated period with payment of prescribed fee.

## Marks Distribution

### Courses with theory and practical

#### CIE:

Mid semester examination = 30 marks (12 marks for Part A which is compulsory + 18 marks for Part-B)

Assignment = 5 marks

Practical = 15 marks (5 marks for record and others + 10 marks for practical examination)

**Semester end examination (SEE) = 50 marks (20 marks for Part-A which is compulsory + 30 marks for Part-B)**

### Courses with theory only

#### CIE:

Mid semester examination = 40 marks (16 marks for Part A which is compulsory + 24 marks for Part-B)

Assignment = 10 marks

**Semester end examination (SEE) = 50 marks (20 marks for Part-A which is compulsory + 30 marks for Part-B)**

### Courses with only practical (Only Internal)

#### CIE:

Class work and Record = 30 marks

Assignment = 10 marks

Viva-voce = 10 marks

External Examination = 50 marks

**5.7 Recounting:** The totaling of the marks awarded shall be verified in the answer script and corrected if there is any mistake.

#### **5.8 Revaluation:**

- a) The answer scripts of the candidate applied for revaluation are evaluated by two subject experts independently other than the original valuer.
- b) If the difference of marks between these two valuations is 15% or more, it will be sent for third valuation to another subject expert.
- c) Nearest of two valuations out of three will be considered and the average of these two will be taken as the final marks obtained.

- d) If the difference of the final marks after revaluation is  $\geq 15\%$  of original marks, then the revaluation marks are considered for declaring the result.
- e) If the revaluation marks are less than the original marks, the original marks remain same and there is no change in the result.

### **5.9 Challenge Valuation:**

The candidates who have applied for revaluation and not satisfied with the result are only eligible to apply for challenge valuation by paying the prescribed fee in the form of DD payable to the Registrar, Anurag University.

- a) On receipt of the DD, a photocopy of the answer booklet shall be given to the student.
- b) The paper will be evaluated in the presence of the student by a senior faculty member appointed by the University.
- c) If there is any change in the marks  $\geq 15\%$  of the maximum marks, the new marks will be awarded to the student. Otherwise, there will be no change in original secured marks.
- d) If the change in marks (equal or above 15% of the maximum marks) occurs, the amount paid towards challenge valuation will be refunded. Otherwise, the student will forfeit the total amount which he/she has paid.

## **6. Advisory System**

- 6.1 The students on their admission shall be divided into convenient batches by the Dean of the college and each batch is assigned to one of the teachers who are designated as 'Advisor'. Each student immediately after enrolment fills up all the registration cards with the guidance of his/her advisor. Among other things, the advisor shall help the students in planning the programs of their studies.
- 6.2 The advisor will establish and foster close personal relationship with students assigned to him/her during their entire stay in the college by having periodical meetings either with the entire batch of students or with each individual student as often as is considered necessary in an effort to know their problems, review their study programs and take such remedial actions as may be necessary in consultation with the teachers concerned and the Dean of Agriculture.
- 6.3 The advisor will maintain a record containing particulars of previous history of the student, courses registered and examinations appeared and grades obtained in each course in each semester as per the format prescribed by the University (Annexure - 1).

## **7. Registration**

- 7.1 A registration and orientation program will be conducted for the benefit of the students joining the University for the first time. A copy of the Academic regulations and syllabi will be given to the students.
- 7.2 Each student has to register for course work at the beginning of each semester as per the schedule mentioned in the academic calendar.
- 7.3 A student would be allowed to register in an additional course only if he/she satisfies all the prerequisites.
- 7.4 Departments will notify at the time of registration about the minimum number of students to be enrolled for a particular course to be offered.

- 7.5 Any student may be barred from registering for any course for specific reasons like disciplinary reasons, non-payment of fees, etc.

## **8. Dropping**

- 8.1 Dropping of courses: Within four weeks after the commencement of the semester, the student may, in consultation with his / her faculty advisor, drop one or more courses. The dropped courses are not recorded in the grade card.

## **9. Attendance Requirements**

- 9.1 A student is eligible to write the Semester end examinations only if he/ she acquire a minimum of 75% attendance in aggregate of all courses upto third year.
- 9.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted on medical grounds as approved by the Academic Council.
- 9.3 A stipulated fee shall be payable towards condonation of shortage of attendance.
- 9.4 Shortage of attendance below 65% in aggregate shall not be condoned.
- 9.5 However, in respect of women candidates who seek condonation of attendance due to pregnancy, the Vice-Chancellor may condone the deficiency in attendance to the extent of 15% (as against 10% condonation for others) on medical grounds subject to submission of medical certificate to this effect. Such condonation shall not be availed twice during the program of study.
- 9.6 Students whose shortage of attendance is not condoned are not eligible to write semester end examinations of that semester. Such students are detained and their registration for examination stands cancelled.

- 9.7 A student detained due to shortage of attendance in a semester may seek re-admission into that semester, as and when offered, within four weeks from the date of commencement of class work with the academic regulations of the batch into which he/she gets re-admitted.

- 9.8 A student will be promoted to the next semester if he/she satisfies the attendance requirement of the present semester and shall not be eligible for readmission into the same semester.
- 9.9 For all mandatory, noncredit courses offered in a semester, a student shall be declared successful or 'passed', if he/she secures  $\geq 75\%$  attendance in such a course. A 'satisfactory participation certificate' for that mandatory course will be issued and no marks or letter grade shall be allotted.
- 9.10 Attendance of N.S.S/N.C.C Camps or Inter collegiate or Inter University or Inter State or International matches or debates or such other Inter University activities as approved by the authorities, will be taken into consideration while calculating the attendance.
- (i) Such leave should be availed with prior permission from the Dean- School of Agriculture and not be availed more than twice during the program of study.
- (ii) Without any prior permission, such leave shall be treated as absence.
- 9.11 For Student Ready Programs in IV year, 85% attendance is compulsory.

## 10. Passing Standards

- 10.1 **Earning a Credit:** A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range 'O' to 'C'. Letter grade 'F' in any course implies failure in that course and no credits earned.

- 10.2 **Semester Grade Point Average (SGPA):** Semester Grade Point Average is the quotient of the total credit points obtained by a student in various courses at the end of each semester divided by the total credit hours taken by him/her in that semester. The grading is done on a 10 point scale. The GPA is to be corrected up to two decimal points.

$$SGPA = \text{Total points scored} / \text{Total credits (of that semester)}$$

- 10.3 **Cumulative Grade Point Average (CGPA):** Cumulative Grade Point Average is the quotient of cumulative credit points obtained by a student in all the courses taken by him/her from the beginning of the first semester of the degree course divided by the total credit hours of all the courses which he/she had completed up to the end of a specified semester from the first semester. It determines overall performance of a student in all the courses taken during a period covering more than a semester.

The CGPA and SGPA is to be corrected up to two decimal point.

$$SGPA = \text{Total Credit Points Scored} / \text{Course Credits}$$

$$CGPA = \text{Total Credit Points Scored} / \text{Total Credits.}$$

$$\% \text{ of marks} = (CGPA - 0.5) \times 10.$$

- 10.4 A student shall be declared successful or 'passed' in a semester, only when he/she gets a SGPA  $\geq 5.00$  (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire UG Program, only when he/she gets a CGPA  $\geq 5.00$ ; subject to the condition that he/she secures a C Grade or above in every registered course.
- 10.5 A student shall be declared successful or 'passed' in any non-credit course, if he/she secures a 'satisfactory participation certificate' for that mandatory course.
- 10.6 After the completion of each semester, a grade card or grade sheet (or transcript) shall be issued to all the registered students of that semester,



indicating the letter grades and credits earned. It will show the details of the courses registered (course code, title, no. of credits etc.), grade earned, credits earned, SGPA and CGPA.

- 10.7 A student shall register and put up required attendance in all courses and earn a total of 185 credits for the award of degree.
- 10.8 When a student is detained due to shortage of attendance in any semester, no grade allotments or SGPA/CGPA calculations will be given for that entire semester in which he/she is detained.
- 10.9 When a student is detained due to lack of credits in any year, he may be readmitted after fulfillment of the academic requirements, with the academic regulations of the batch into which he/she gets readmitted.
- 10.10 For readmitted candidates, if there are any professional electives / open electives, the same may also be re-registered if offered. However, if those electives are not offered in later semesters, then alternate electives may be chosen from the set of elective courses offered under that category.
- 10.11 A 10% relaxation or concession of marks in pass percentage shall be given to physically challenged students.
- 10.12 **Promotion Rules:** The Rules of promotion are as follows.

Promotion	From I Yr. to II Yr.	From II Yr. to III Yr.	From III Yr. to IV Yr.
<b>Condition to be fulfilled</b>	50% of the total credits up to I Yr. II Sem.	50% of the total credits up to II Yr. II Sem. And all the courses of first year are to be passed	<b>Total credits are to be cleared up to III Yr. II Sem.</b>

## 11. Program Structure

- 11.1 The program structure is in-line with the guide lines as suggested by ICAR.

## 12. Grade Points

- 12.1 Marks will be awarded to indicate the performance of each student in each theory courses or lab/practical/seminar/project/mini-project etc., based on the percentage of marks obtained in both CIE and SEE taken together as specified in Item 5 above, and a corresponding letter grade shall be given.

- 12.2 A 10 point absolute grading system using the following letter grades and corresponding percentage of marks shall be followed as given below:

Letter Grade		Grade Points	% of Marks Secured(M)(Class Intervals)
O	Outstanding	10	M≥90%
A+	Excellent	9	80≤ M<90
A	Very Good	8	70≤ M<80
B+	Good	7	60≤ M<70
B	Average	6	50≤ M<60
F	Fail	0	M<50
Ab	Absent	0	--

- 12.3 A student obtaining 'F' grade in any subject shall be considered as 'failed' and will be required to reappear as 'supplementary candidate' in the SEE, as and when conducted. In such cases, CIE in those subject(s) will remain same as those the student obtained earlier.

- 12.4 A letter grade does not imply any specific % of marks.

- 1.1 In general, a student shall not be permitted to repeat any course (s) only for the sake of 'grade improvement' or 'SGPA/CGPA Improvement'.

- 1.2 A student earns grade point (GP) in each course, on the basis of the letter grade obtained by him in that course (excluding mandatory non-credit courses). Then the corresponding 'credit points' (CP) are computed by multiplying the grade point with credits for that particular course.

**Credit Points (CP) = Grade Point (GP) x Credits** (for a course)

- 1.3

## 2. Award of Class

2.1 A student who registers for all the specified courses as listed in the program and secures the required number of 185 credits (with CGPA  $\geq$  5.0), within eight academic years from the date of commencement of the first academic year, shall be declared to have 'qualified' for the award of the B. Sc. (Honors) Agricultural Science degree.

CGPA	Class	Condition
CGPA $\geq$ 8.00	First Class with Distinction	<ul style="list-style-type: none"><li>• Should pass all the courses in semester 'regular examinations' and should complete the program in 4 years of time.</li><li>• Should not have been detained or prevented from writing the semester end examinations in any semester due to shortage of attendance or any other reason.</li></ul>
6.50 $\leq$ CGPA $<$ 8.00	First Class	<ul style="list-style-type: none"><li>• The Students who secure CGPA <math>\geq</math> 8.00, but not fulfilling the conditions for "First Class with Distinction" shall be awarded 'First Class' only.</li></ul>
5.50 $\leq$ CGPA $<$ 6.50	Second Class	
5.0 $\leq$ CGPA $<$ 5.50	Pass Class	

1.1 The CGPA can be converted to equivalent percentage of marks by using the following formula:

$$\text{Percentage(\%)} \text{ of marks} = (\text{CGPA} - 0.5) \times 10$$

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## **2. Supplementary Examinations**

- 2.1 A student eligible to appear for semester end examinations in a course, but absent/failed in that examination, may write the exam in that course during supplementary examinations. In such cases, CIE assessed earlier for that course will be carried over and added to the marks to be obtained in the supplementary examinations.

## **3. Withholding of Results**

If the student has not paid the dues, if any, to the University or if any case of indiscipline is pending against him, the result will be withheld, and he will not be allowed into the next semester. In such cases the matter will be referred to the academic council. The decision of the academic council is final.

## **4. Transcripts**

After successful completion of the total Program of study, a Transcript containing performance of all academic years/semesters will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee.

## **5. Convocation**

- 5.1 The University shall conduct convocation ceremony to confer the degree(s).  
5.2 The University shall institute Prizes and Awards to meritorious students during convocation.

## **6. Termination from the program**

The admission of a student to the program may be terminated in the following circumstances:

- 6.1 The student fails to satisfy the requirements of the program within the maximum period stipulated for that program.  
6.2 The student fails to satisfy the norms of discipline specified by the university from time to time.

## **7. Non-Credit Courses (Mandatory Courses)**

- 7.1 All the courses designated as mandatory course is a compulsory requirement for all students for the award of degree.
- 7.2 These activities carry no credits and are evaluated as satisfactory/unsatisfactory.
- 7.3 Minimum attendance requirement as per the regulations is compulsory for completing the mandatory courses.

## **8. Amendments**

- 8.1 The regulations hereunder are subject to amendments as may be made by Academic Council from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program).

**ANNEXURE – I:****Calculation of Grade Point Average****1 Grade Point Average****1.1 SGPA and CGPA**

The *credit index* can be used further for calculating the Semester Grade Point Average (*SGPA*) and the Cumulative Grade Point Average (*CGPA*), both of which being important performance indices of the student. While *SGPA* is equal to the *credit index* for a semester divided by the total number of *credits* registered by the student in that semester, *CGPA* gives the sum total of *credit indices* of all the previous semesters divided by the total number of *credits* registered in all these semesters. Thus,

The Grade Point Average (GPA) will be calculated according to the formula:

$$\text{GPA} = \frac{\sum C_i G_i}{\sum C_i}$$

Where  $C_i$  = number of credits for the course  $i$ ,

$G_i$  = grade points obtained by the student in the course.

Semester grade point average (SGPA) is calculated up to second decimal point and it is calculated only when all subjects in that semester are cleared / passed.

$$\text{SPGA} = \frac{\sum[(\text{Course credits}) \times (\text{Grade points})]}{\sum[\text{Course credits}]}$$

To arrive at cumulative grade point average (CGPA), the formula is used considering the student's performance in all the courses taken in all the semesters completed up to the particular point of time. CGPA is rounded off to TWO decimal places.

$$\text{CPGA} = \frac{\sum[(\text{Course credits}) \times (\text{Grade points})]}{\sum[\text{Course credits}]}$$

CGPA is thus computed from the I Year First Semester onwards, at the end of each semester, as per the above formula. However, the SGPA of I year I semester itself may be taken as the CGPA, as there are no cumulative effects.

### 1.2 Illustrative Example

An illustrative example given below indicates the use of the above two equations in calculating SGPA and CGPA, both of which facilitate the declaration of academic performance of a student, at the end of a semester and at the end of successive semesters respectively.

Year and Semester	Course No.	Credits	Grade	Grade points	Credit points
I Year I Sem.	XX101	4	A	8	32
I Year I Sem.	XX102	4	B	6	24
I Year I Sem.	XX103	4	A+	9	36
I Year I Sem.	XX104	4	A	8	32
I Year I Sem.	XX105	1.5	O	10	15
I Year I Sem.	XX106	1.5	A+	9	13.5
<b>Total</b>		<b>19</b>			<b>152.5</b>
	<b><i>SGPA = 152.5/19 = 8.03</i></b>			<b><i>CGPA = 8.03</i></b>	
I Year II Sem.	XX107	4	B+	7	28
I Year II Sem.	XX108	3	A	8	24
I Year II Sem.	XX109	3	B	6	18
I Year II Sem.	XX110	4	C	5	20
I Year II Sem.	XX111	2	A+	9	18
I Year II Sem.	XX112	1.5	O	10	15

I Year II Sem.	XX11 3	1.5	O	10	15
<b>Total</b>		<b>19</b>			<b>138</b>
	$SGPA = 138/19 = 7.26$			$CGPA = \frac{152.5+138}{(19+19)} = 7.64$	

### 1.3 Assignment/Seminars/Projects/Group activities:

The faculty will evaluate the students by conducting any of the following: assignments/ seminars/ projects/ group activities before the conduct of second midterm examination.

### 1.4 Computation and award of course grades

In respect of RAWE Programme/ Inplant Training / Industrial Attachment / Hands on Training / Skill Development Training and ELP etc., the criteria for evaluation of students as prescribed in manuals of respective programmes shall be followed.



### **3. Amending or cancellation of result**

If the result of a candidate is discovered to be vitiated by error, malpractice, fraud, improper conduct or any other reasons, the Vice Chancellor shall have the power to amend the result in such a manner as to accord with the true position, and to make such declaration as the Vice Chancellor may deem necessary in that behalf. If it is found that the result of a candidate has been vitiated

By

Mal practices, fraud or other improper conduct where by he has been benefited and that he has in the opinion of the Vice Chancellor, been a party to or connived at the malpractice, fraud or improper conduct, the Vice Chancellor shall have the power at any time, notwithstanding the award of the Diploma or a Certificate or Prize or a Scholarship, to amend the result of such candidate and to make such declaration as the Vice Chancellor may deem necessary in, that behalf, including debarring of the candidate from the University for such a period as may be specified and the cancellation of the result of the candidate in such manner as the Vice Chancellor may decide.

### **4. Transitory provision**

These regulations shall apply to the students who shall be admitted from the academic year 2021-22 and onwards.

5. No Regulation made by the Academic Council, governing the under graduate courses of study shall be constructed to limit or abridge the powers of the Academic Council to deal with any case or cases of any student or students of the under graduate courses in such manner as it may appear to it to be just and equitable.

## **ANNEXURE – II:**

### **Disciplinary Action against Students – Provisions**

1. Student's behavior and discipline will be assessed and will receive the same attention as the academic work. Discipline includes the observance of good conduct and orderly behavior by the students of the University.
2. All students pursuing a Program at the University shall observe code of conduct and maintain discipline and must consider it as a duty to behave decently at all places.
3. Every student shall always carry the Identity card issued by the University. Every student shall have to produce or surrender the identity card, as and when required by the proctorial staff, teaching and library staff and the officials of the university. The loss of the identity card, whenever it occurs, shall immediately be reported in writing to the Registrar.
4. Any violation of the code of conduct or breach of any rules and regulations of the University is construed as an act of indiscipline and shall make him / her liable for disciplinary action.
5. The following acts are treated as gross indiscipline.
  - a) Disobeying the teacher/officials or misbehaving in the class.
  - b) Quarrelling or fighting in the University campus or in the hostels amongst themselves, or indulging in any activity which amounts to ragging or harassment of other students.
  - c) Quarrelling or fighting with a University employee(s) or any other public utility functionaries in the campus.
  - d) Indecent behavior in the campus or outside causing inconvenience to others.
  - e) Visiting socially unacceptable websites, smoking or consuming liquor or banned substances like drugsetc.
  - f) Damage to the University property.
  - g) Indulging in acts of theft, forgery, stealing and misappropriating.
  - h) Any other activity that defames the University;
    - i. Use of mobile in the class/academic area.
    - ii. Irregularity in attending classes, persistent idleness, negligence or indifference towards the work assigned.
    - iii. Any other conduct which is considered to be unbecoming of student.

## **ANNEXURE – III:**

### **Rules for Students Conduct & Behavior in Campus and Outside**

1. The rules and regulations, academic calendar shall be provided to students.
2. In general, Dean - Student Affairs will deal with the welfare and discipline of all students in the campus including Hostel and also outside the campus and will ensure maintenance of good conduct. He/she will be assisted by other members of faculty/ staff/ wardens as nominated.
3. Conduct and Behavior:
  - a) Students should attend all their classes and strictly observe class timings. They should likewise carry out other out-door and extracurricular duties assigned to them. Their attendance and leave are governed by the regulations pertaining to them.
  - b) Students must give their undivided attention to their academic work and must be respectful to their teachers and supervisors.
  - c) Students must conduct themselves with due decorum in the classes, laboratories, library etc. and move in an orderly and disciplined manner in the campus.
  - d) Students should not indulge in abusive behavior/ violence of any kind with fellow students, teaching faculty and employees of the University within or outside the University. Violence by any student or group of students will lead to severe disciplinary action.
  - e) No meeting of the students other than those organized under the aegis of the various recognized students' activities shall be called without the prior permission in writing from the Dean, Student Affairs.
  - f) Neither meetings/functions within the University campus shall be organized nor any outsider address the students without the prior permission in writing from the Registrar.
  - g) No students shall use unfair means at any of the examinations and tests or attempt or threaten the staff to get undue advantage.
  - h) Students must pay all fees and other dues on specified dates. If they do not do so, they render themselves liable to penalties as in force from time to time.
  - i) Students must take good care of all University property. Any damage to University property shall be viewed as indiscipline. Such students, in addition to facing the disciplinary action, shall have to replace the damaged property and make good the losses caused due to their action. Students must use the furniture and fittings with due care and must not deface buildings, roads, furniture and fittings etc. in any manner.
  - j) Students must handle the laboratory equipment, instruments and machinery with great

care. Any damage or breakage of such equipment etc., due to improper use and negligent handling will have to be made good by the students concerned.

- k) Ragging in any form is unlawful and strictly prohibited. If a student is found in ragging activity he/she shall be punished as per the Anti-Ragging Act.
- l) The University shall have a zero-tolerance policy towards Ragging and shall lay down strict guidelines on the same as per policies of the UGC in vogue and in compliance to directions of Hon'ble Supreme Court.
- m) Mobile/cellular phone shall be kept in silent mode during the classes and violation will lead to confiscation of the mobile phone.
- n) All the students are required to observe the decorum in the dress code as prescribed by the University. Students not adhering to the prescribed dress code may be denied entry to the University campus;
- o) Smoking, consumption/possession of liquor, intoxicants, drugs, cigarettes, hookah etc., inside or outside the Campus is strictly prohibited. Any violation will invoke severe penalty including rustication from the Hostel/University.

#### 4. Policy to prevent Sexual Harassment:

- a. The University shall be committed to treating every employee and student with dignity and respect. It shall seek to create a work environment that is free from sexual harassment of any kind, whether verbal, physical or visual;
- b. A policy shall be prescribed by the University to provide guidelines for prompt redressal of complaints related to sexual harassment which should be in full compliance with "The Sexual Harassment of Women at Workplace (Prevention, Prohibition & Redressal)" Act, 2013;
- c. All references / complaints and redressal mechanism pertaining to any matter will be handled within the ambit of the said Act and the Rules framed there under. The policy so prescribed shall be communicated to all employees and students.

#### 5. Grievance and Redressal Mechanisms:

The University shall constitute various Grievance and Redressal committees and its guidelines as specified by the statutory authorities of the University.

### ANNEXURE – IV:

#### Malpractices Rules

S · N o	Nature of Malpractice Improper conduct during examinations	Punishment
	<i>If the candidate:</i>	
1 · ( a )	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he/she is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
( b )	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he/she will be handed over to the police and a case is registered against him/her.
2 ·	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The hall ticket of the candidate is to be cancelled.

3 .	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all Semester end examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he/she will be handed over to the police and a case is registered against him/her.
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4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination. Takes away answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all SEEs. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent / Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty inside or outside the examination hall or causing any injury to himself / herself or to any others or threatens whether by words, either spoken or written or by signs or by visible representation, assaults the officer in-charge, or any person on duty in or outside the examination hall or any others, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	They shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case will be registered against them.

7	Leaves the exam hall taking away answer script or intentionally tearsthe script or any part-thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work & shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from classwork and all Semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remainingexaminations of the subjects of that semester/year. The candidate is also debarred and forfeits these at.
9	Who is not a candidate for the particular examination or any person not connected with the University indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to theUniversity will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remainingexaminations of the subjects of that semester/year.



1 1 ·	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
1 2 ·	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the malpractice committee for further action on suitable punishment as per rules.	

**General:**

- **The academic regulations should be read as a whole for the purpose of any interpretation.**
- **In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chancellor is final.**

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## First year courses

### FIRST YEAR I SEMESTER

CODE	Course title	Credits
A11101	Agriculture Heritage*(Remedial)	1(1+0)*
A11102	Fundamentals of Agronomy	3(2+1)
A11001	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
A11030	Comprehension and Communication Skills in English	2 (1+1)
A11020	Elementary Mathematics*	2(1+1)*
A11021	IT Worksop	1(0+1)
A11111	Fundamentals of Genetics	3(2+1)
A11141	Fundamentals of Economics	3(3+0)
A11181	Fundamentals of Horticulture	2 (1+1)
A11190	Human Values and Ethics (non gradial)	1(1+0)**
A11191	Rural Sociology and Educational Psychology	2 (1+1)
A11040	NSS/NCC/Physical Education and Yoga Practices**	2 (0+2)**
		<b>Total 25 (15+10)</b>

### II SEMESTER

CODE	Course title	Credits
A12010	Agricultural Microbiology	2(1+1)
A12103	Introductory Agrometeorology and Climate Change	2 (1+1)
A12104	Introduction to Forestry	2 (1+1)
A12121	Fundamentals of Soil Science	3(2+1)
A12131	Fundamentals of Entomology I(Insect Morphology and Taxonomy)	3(2+1)
A12151	Soil and Water Conservation Engineering	2(1+1)
A12162	Fundamentals of Crop Physiology	3(2+1)
A12171	Fundamentals of Plant Pathology I(Plant Pathogens - An Introduction)	3(2+1 )
<b>A12182</b>	Production Technology of Fruits and Plantation Crops	2 (1+1)
		<b>Total 22 (13+9)</b>

**\*Remedial \*\* Non Gradial**

**Lecture out lines for first and second semester courses of first year B.Sc (Hons)**

**Agriculture 2021-22 academic year**

**I year B.Sc (Hons) Agriculture- I Semester**

**Course Code A11101\***

**Agriculture Heritage**

**Credits: 1(1+0)**

**UNIT- 1**

Introduction to Indian agricultural heritage–Definition of heritage, agriculture heritage- Need to study agriculture heritage. Genesis of agriculture and its chronological arrangement-Homes of evolution of agriculture and “old and new” world- Early indigenous domestications. Status of farmers in society and specific role of women in ensuring food security- Farming systems in ancient periods. Status of agriculture and advice by sages to kings on their duties towards farmers- Importance of farmers- Ancient agricultural practices and scientific basis.

**UNIT- 2**

Soil management in ancient, medieval, pre-modern India –Historical background- Soil management and its relevance in pre-modern India and modern day sustainable agriculture- Use of amendments- Land management, Piercing, tillage, puddling and pre- plant submergence, mulching, fallowing. Soil concept- Ancient systems of soil classification- Ancient systems of soil management- Medieval and pre-modern soil management. Heritage of crop and water management– Ancient and pre-historic period; Medieval period.

**UNIT- 3**

Plant growth and development- Heritage of plant protection through vrikshayurveda and traditional Knowledge. Plant protection in ancient India-Plant disorders–Cause, symptoms, treatment materials. Traditional knowledge in crop production and water management.

**UNIT- 4**

Heritage of medicinal plants and their relevance today. Seed health in ancient and medieval history and its relevance to present day agriculture-seed health in Hellenistic age–seed health in India- Materials recommended for seed treatments. Description of Indian civilization and agriculture by travelers from China, Europe and USA.

**UNIT- 5**

Pre-historic cropping patterns. Our journey in agriculture- Green revolution and its impact and concerns. Vision for the future–Challenges ahead.

## References

1. Choudary S.L, Sharma, G.S, and Nene, Y.L (eds). 2000. Ancient and Medieval History of Indian agriculture and its relevance to sustainable agriculture in the 21<sup>st</sup> century; Proceedings of the summer school held from 28 May to 17 June 1999. Rajasthan college of Agriculture, Udaipur 313001.
2. Nene, Y.L (Ed). 2005. Agricultural Heritage of Asia proceedings of the international conference, 6-8 December 2004, Asian-Agri history Foundation, Secunderabad-500 009, Andhra Pradesh, India.
3. Nene, Y.L. 2007. Glimpses of Agricultural heritage of India. Asian-Agri-History Foundation, 47-ICRISAT Colony-1 Brig sayeed Road, Secunderabad-500009 A.P India 901 PPI ISBN-81-903963-0-7.

Course Code A11102

FUNDAMENTALS OF AGRONOMY

Credits 3(2+1)

### UNIT- 1

Agriculture- Agronomy and its scope- Role of Agronomists in resource management for crop production. Tillage and tith- Objectives of tillage- Characteristics of ideal seedbed- Effect of tillage on soil properties. Types of tillage-Factors affecting tillage and seedbed preparation-After cultivation-Puddling. Concepts of tillage-Minimum tillage, zero tillage, strip tillage, conservation tillage and their advantages and limitations. Seeds and sowing- Characteristics of good quality of seed, seed treatment, agronomic significance of seed purity and quality- Methods of sowing, importance of time and depth of sowing. Crop density and geometry- Crop stand establishment, factors affecting optimum stand establishment. Plant population- Competition, types of competition, intra and inter plant competition- Effect of plant population on growth and yield, optimum plant density and planting pattern.

### UNIT- 2

Soil fertility and soil productivity- Soil organic matter and its importance- Loss of soil fertility and its maintenance. Crop nutrition-Essential plant nutrients- Primary, secondary and micronutrients- Nutrient uptake-Nutrient use efficiency. Manures and fertilizers- Types of manures and fertilizers- Factors influencing methods and time of fertilizer application-Bio-fertilizers. Irrigation-Importance of Irrigation-Objectives of irrigation- Methods of irrigation and water use efficiency. Crop growth and development- Factors affecting growth and development- Agronomic manipulation of crop growth and development. Plant ideotypes - Concept, definition-Morphological and physiological characteristics of new plant types.

### UNIT- 3

Cropping pattern, Cropping system-Crop rotation- Principles of crop rotation- Monocropping and its disadvantages- Types of cropping systems-Mixed, multiple, intercropping, relay and multistoried cropping. Crop adaptation and distribution in India and Andhra Pradesh- Factors influencing crop adaptation and distribution. Common problems in crop production related to climate, soil, pest and disease incidence- Crop management technologies to overcome the problems identified. Dry farming, dryland farming and rainfed farming-Classification of climate-Problems of crop production in dry areas. Soil moisture conservation and water harvesting measures-Watershed: Objectives and components - Watershed management. Weed-Definition-Importance-Harmful and beneficial effects of

weeds–Aquatic weeds.

#### **UNIT- 4**

Classification of weeds–Based on morphology, lifecycle, habitat, origin, association and special features with examples. Propagation of weeds–Sexual–Asexual–Vegetative (Rhizomes, rootstocks, runners, stolons, suckers, offsets, tubers, bulbs, bulbils, stems and roots). Weed biology–Characteristic features of weeds, weed ecology– Persistence of weeds, climatic, edaphic and biotic factors. Crop weed association– Factors affecting crop weed competition –Common weeds associated with major crops. Crop-weed-competition–Critical period of crop weed competition–Allelopathy. Methods of weed management–Prevention, control and eradication–Physical, mechanical and cultural methods- Chemical and biological methods of weed control–Integrated weed management.

#### **UNIT- 5**

Herbicides–Definition, advantages and limitations of herbicide usage in India.- Bioherbicides. Classification of herbicides based on chemical nature, time and method of application. Herbicidal formulations–active ingredient–Nomenclature of herbicides. Adjuvants and their use in herbicide application–Types of adjuvants with examples. Mode of action of herbicides–Important biochemical modes of action of herbicides. Selectivity and resistance- Selectivity of herbicides- Fundamental principles of selectivity–Differences in morphology and growth habit of plants–Differential absorption and translocation of herbicides. Harvesting and threshing of crops- Maturity symptoms of major crops- Time and methods of harvesting.

#### **Practical**

1. Visit to college farm and identification of major crops and varieties
2. Practice of primary tillage implements and puddling
3. Practice of secondary tillage implements
4. Practice of seeding equipment, inter cultivation implements
5. Seed germination and viability test–Study of sowing depth on germination and seedling vigour
6. Identification of manures, fertilizers and green manure crops/seeds.
7. Practice of manure and fertilizer application
8. Participation in ongoing field operations
9. Participation in ongoing field operations
10. Identification of weeds in field crops and other habitats
11. Study of weed flora in different weed management practices and calculation of herbicide efficiencies (WI & WCE)
12. Herbicide label information and computation of herbicide doses
13. Study of herbicide application equipment and calibration
14. Herbicide application and precautionary measures

15. Study of herbicide phytotoxicity symptoms in different crops

16. Identification of maturity symptoms of different crops

### References

1. Reddy, S.R. 2016. Principles of Agronomy. Kalyani Publishers, Ludhiana-5<sup>th</sup> edition
2. Yellamanda Reddy, T. and Sankara Reddi, G.H. (2016). Principles of Agronomy. Kalyani Publishers, Ludhiana.
3. Gopal Chandra de. 1989. Fundamentals of Agronomy. Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.
4. Gupta, O. P. 2011. Modern weed management. Agrobios(India), Jodhpur.

Course Code A11 111

FUNDAMENTALS OF GENETICS

Credits 3(2+1)

#### UNIT- 1

Pre Mendelian concepts of heredity—Early history of heredity, inheritance of acquired traits, preformation theory, pangenesis and germplasm theory. Chromosome-Structure of chromosome, types of chromosomes based on position of centromere. Cell division—Cell cycle—Mitosis-Process of mitosis-Significance. Meiosis – Process – Differences between mitosis and meiosis - Significance. Mendelian principles of heredity – Terminology, Mendel’s experiments - Reasons for selection of pea as experimental material- characters studied - Reasons for Mendel’s success. Mendel’s laws – Law of segregation – Law of independent assortment – Principle of dominance – Principle of unit characters – Exceptions to Mendel’s laws – Rediscovery of Mendelian principles. Probability and Chi-square – Concept of probability, predicting results of a monohybrid cross, predicting results of a dihybrid cross - Chi-square test.

#### UNIT- 2

Dominance relationships – Complete dominance, incomplete dominance, co- dominance, over dominance, pseudo dominance, lethal factors. Gene interaction – Non epistatic interaction – Interaction of factors; epistatic interactions – Complementary epistasis, dominant epistasis. Recessive epistasis, duplicate dominant gene action, dominant suppression or inhibitory gene action, duplicate genes with cumulative effect. Multiple alleles – Characteristics of multiple alleles – Blood groups in humans, coat colour in rabbits, self-incompatibility alleles in plants - pleiotropism, penetrance and expressivity. Linkage – Definition – Classification of linkage – Characteristic features of linkage –Linkage groups. Detection of linkage – Estimation of linkage – Importance of test cross in linkage studies – significance in plant breeding.

#### UNIT- 3

Crossing over mechanisms – Mechanism of crossing over – Types of crossing over-Factors affecting crossing over. Significance of crossing over in plant breeding – Cytological proof of crossing over in *Drosophila*. Chromosome mapping – 2 – point and 3 – point test cross – Cytological maps and genetical maps – Coincidence and interference. Sex determination – Various mechanisms of sex determination – Chromosomal sex determination, genic balance mechanism of sex determination in *Drosophila melanogaster*, male haploidy, single gene

effects etc. Sex linkage – White eye colour in *Drosophila*, colour blindness and haemophilia in humans-sex influenced traits – Horns in sheep, baldness in humans, sex limited - Milk production in cattle, beard in man – Pseudo hermaphrodites – Gynandromorphs. Qualitative and Quantitative traits, Polygenes and continuous variations – Definition-Inheritance and their differences, multiple factor hypothesis.

#### UNIT- 4

Cytoplasmic inheritance – Definition – Chloroplast inheritance (leaf variegation in *Mirabilis jalapa*) – mitochondrial inheritance (cytoplasmic male sterility in maize) - Characteristic features of cytoplasmic inheritance - Differences between chromosomal and extra chromosomal inheritance. Nature and structure of genetic material – DNA and its structure – Watson and Crick’s model – Function – Experiments to prove DNA as genetic material. Replication of DNA – Modes of DNA replication - Semi-conservative DNA replication Experimental proof. Types of RNA – Messenger RNA, ribosomal RNA and transfer RNA – structure of tRNA, differences between DNA and RNA. Protein synthesis – Central dogma, transcription and translational mechanism of genetic material – Genetic code – Properties of genetic code – Wobble hypothesis. Steps in protein synthesis – Transcription and translation. Gene regulation – Lac operon concept – Gene concept – Cistron – Recon – Muton.

#### UNIT- 5

Mutation – Classification – Gene mutations – Introduction – Definition – Types of mutations – Spontaneous and induced mutations – Point mutations – Characters of mutations – Xenia and metaxenia– Chimeras Types and their significance in plant breeding. Methods of inducing mutations, Physical and chemical mutagens – Detection of sexlinked lethals in *Drosophila* (CIB method given by Muller). Molecular basis of mutations - Transitions, transversions and frame shift mutations. Importance of mutations in plant breeding. Structural changes in chromosome – Breakage – fusion – bridge cycle - Deletions(deficiency) – Duplications and their significance in plant breeding. Inversions – pericentric inversions and paracentric inversions – inversions as cross oversuppressors. Translocations – simple and reciprocal – their role in plant breeding.

#### Practical

1. Study of microscope.
2. Study of cell structure.
3. Practice on mitotic cell division.
4. Practice on meiotic cell division.
5. Practice on meiotic cell division.
6. Probability and Chi-square test.
7. Monohybrid and its modifications.
8. Dihybrid.
9. Trihybrid.
10. Testcross and backcross.
11. Epistatic interactions including testcross and backcross.
12. Epistatic interactions including testcross and backcross.
13. Epistatic interactions including test cross and backcross.
14. Determination of linkage and cross over analysis (through two point test cross data).

15. Determination of linkage and cross over analysis (through three point test cross data).
16. Study of models on DNA and RNA structure.

### References

1. Pundhan Singh. 2006. *Genetics*. Kalyani Publishers, Ludhiana.
2. Singh, B.D. 2015. *Fundamentals of Genetics*. Kalyani Publishers, Ludhiana.
3. Gupta, P.K. 2007. *Genetics*. Rastogi Publications, Meerut.
4. Khanna, V.K. 2002. *Genetics Numerical Problems*. Kalyani publishers. 2<sup>nd</sup> edition.
5. Pundhan Singh. 2011. *Genetics at a Glance*. Kalyani Publishers, Ludhiana.
6. Verma, P. S. and Agarwal, P. K. 2013. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology*. S. Chand & Company Pvt. Ltd., Kolkata.
7. Snustad, D.P. and Simmons, M.J. 2010. *Principles of Genetics*. 5<sup>th</sup> Ed. John Wiley & Sons, 111, River Street, Hoboken, NJ, U.S.A.
8. Strickberger, M.W. 2006. *Genetics*. Prentice – Hall of India Pvt. Ltd., New Delhi.

**Course Code A11001                      FUNDAMENTALS OF PLANT BIOCHEMISTRY AND BIOTECHNOLOGY                      Credits 3(2+1)**

### UNIT- 1

Introduction – Historical aspects of Biochemistry– Scope, impact and importance of Biochemistry in plant sciences–Properties of water–PH–Buffers. Carbohydrates–Classification–Structures–Monosaccharides–Structural aspects mutarotation - Reducing and oxidizing properties. Oligosaccharides and polysaccharides–Functions of carbohydrates. Lipids–Fattyacids–Structures and properties–Functions of lipids. Lipids–Classification–Storage lipids and membrane lipids–Saponification,hydrogenation, Iodine number and Acid value. Amino acids – Structures - Classification – Zwitterions –Titration. Peptides–Oligopeptides–Cyclic and acyclicpeptides–Malformin, Glutathione, Gramicidin – Functions of peptides.

### UNIT- 2

Proteins–Importance–Classification–Properties of proteins–IsoelectricPH– Denaturation - Protein sequencing –Edman degradation method. Proteins–Structural organization–Primary, secondary, tertiary and quaternary structuresand forces involved in stabilizing proteins. Enzymes–Characteristics of enzymes–Chemical nature, speed, specificity, active site - activation energy – Mechanism of enzymeaction. Classification of enzymes–Isoenzymes–Multi enzyme complex–Allosteric enzymes and coenzymes. Measurement of enzyme activity–Factors effecting enzyme activity–Enzyme Inhibition – MM & LB plots. Nucleicacids–Functions–Structures of nitrogen bases–Nucleosides– Nucleotides inRNA and DNA.

### UNIT- 3

Various types of DNA and RNA–Secondary structure of B-DNA and t-RNA. Metabolism–Anabolism and Catabolism–Stages of respiration–Overall metabolicview of carbohydrates, proteins and lipids. Metabolism of carbohydrates–Glycolysis–Aerobic and anaerobic.



Tricarboxylic Acid (TCA) cycle—Glyoxalate cycle—Electron transport chain 18 Metabolism of lipids—Biosynthesis of fatty acids and triacylglycerol. Catabolism of lipids oxidation of fatty acids in brief and oxidation in detail. Protein Biosynthesis and post translational modifications.

#### **UNIT- 4**

Secondary metabolites—Terpenoids—Alkaloids—Phenolics—Importance. Biotechnology—Major—Concepts and importance—Applications of plant biotechnology. Introduction to plant tissue culture—History—Scientists—Terminology—Steps in general tissue culture—Types of sterilization and nutrient media—Types of cultures Organ cultures, cell suspension culture, callus culture, pollen culture and their applications. Micro propagation—Procedure techniques—Organo genesis and embryogenesis - Problems – Advantages – Limitations. Anther culture—embryo culture—Ovule culture—Somatic embryogenesis- Synthetic seeds and its applications. Protoplast isolation and fusion—Somatic hybridization—Cybrids— Soma clonal variations and applications in crop improvement—Cryo preservation.

#### **UNIT- 5**

Recombinant DNA methods-Introduction to genetic engineering—Definitions— Gene cloning - Vectors. Gene transfer methods—Indirect methods (Agrobacterium) and direct methods (physical-gene gun method; chemical-PEG mediated and other methods)with case studies /examples. Transgenic plants—Present status -Applications in crop improvement— Limitations –bio technology regulations. Polymerase chain reaction (PCR) –Procedure and applications. Markers-Morphological, biochemical and molecular markers—RFLP,RAPD and SSR –Marker assisted selection for crop improvement.

#### ***Practical***

1. Preparation of solutions, pH and buffers.
2. Qualitative tests for carbohydrates.
3. Qualitative tests aminoacids.
4. Estimation of amylose in rice.
5. Estimation of reducing sugar/Total soluble sugars.
6. Estimation of proteins by Lowry's method.
7. Extraction of oil from oil seeds by Soxhlet apparatus.
8. Effect of pH, temperature and substrate concentration on enzyme action.
9. Paper chromatography/TLC demonstration for separation of aminoacids. 10  
Sterilization techniques.
- 11 Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium.
- 12 Callus induction from various explants.
- 13 Micropropagation – Hardening and acclimatization.

- 14 Demonstration of isolation of DNA and of gelelectrophoresis technique. 15  
Demonstration of PCR Technique.
- 16 Demonstration of DNA fingerprinting–RAPD and Restriction digestion.

**References:**

1. David L. Nelson, Michael M.Cox; W.H. Freeman.Lehninger*Principles of Biochemistry*, 6th Edition
2. *Biochemistry*,Dr.U.Satyanarayana,Dr.U.Chakrapani,Books and Allied(P)Ltd,Kolkata
3. *Biochemistry*,S.N.Gupta,Rastogi Publications,FirstEdition,2011
4. *Introduction to Plant Biotechnology* by HSCawla(3rdEdition),Oxford&IBH Publishing Co. Pvt Ltd., NewDelhi

Course Code A11141

FUNDAMENTALS OF ECONOMICS

Credits 3(3+0)

**UNIT- 1**

Introduction to Economics– Economic activity and concept of economy and its functions, basic economic problems, three main economic actors-households, firms, governments as basic decision-making units. Economics - Meaning, definitions, its importance as a subject to science students. Scope of study of economics as a science -Subject matter of economics – Traditionalapproach – Consumption, production, exchange, distribution and public finance/ public policy - Modern Approach – Microeconomics and macroeconomics. Methods of economic investigation – Deduction and induction approaches, positive and normative analysis - Nature of economic theory - Rationality assumption, economic laws as generalization of human behaviour. Basic concepts: goods and services-Characteristics and classification, scarcity, choice, decision making, wants, substitutes and complements - Utility – Cardinal and ordinal approaches, forms of utility, marginal utility. Cost and price, value and wealth and their characteristics, capital, income, investment,welfare, efficiency, equilibrium and firm. Demand - Meaning, law of demand, demand schedule and demand curvecharacteristics, determinants, types of demand - Income demand, price demand, cross demand - Product demand, firm demand, market demand. Market dynamics due to changes/ shifts in demand and prices - Contraction and extension, increase and decrease in demand. Law of diminishing marginal utility – Statement, assumptions of law, explanation, limitations of the law - Importance and applications. Law of equi-marginal utility – Meaning, assumptions, explanation of the law - Practical importance and applications, limitations.

**UNIT- 2**

Consumer’s surplus – Meaning, assumptions, explanation with examples, difficulties in measuring, consumer’s surplus- Importance and applications-Engels law of family expenditure. Indifference curve analysis - Indifference curves - Meaning, basic assumptions, properties and their importance in economics. Budget line and its properties - Consumer’s equilibrium - Graphical and algebraic expressions and its importance. Elasticity of demand –

Meaning, elastic and inelastic demand, measurement of elasticity of demand - Types of elasticity of demand - Price elasticity, income elasticity and cross elasticity of demand. Kinds of elasticity of demand - Perfectly elastic, perfectly inelastic, relatively elastic, relatively inelastic, unitary elastic demand - Factors affecting elasticity of demand, practical importance of elasticity of demand. Production-Meaning of production process, creation of utility, factors of production and input - output relationship and production function – Meaning. Laws of returns-Increasing, decreasing and constant laws of returns-Meaning and explanation with examples. Cost-Seven production costs-Meaning and formulas, cost and output relationships – Short run and long run cost curves. Supply – Meaning, definition, law of supply, supply schedule, supply curve and properties, determinants of supply - Market dynamics due to changes/shifts in supply and prices- Increase and decrease in supply, contraction and extension of supply.

### **UNIT- 3**

Elasticity of supply and its measurement- Kinds of elasticity of supply–Perfectly elastic, perfectly inelastic, relatively elastic, relatively inelastic and unitary elastic - Factors affecting elasticity of supply. Markets and market structure – Meaning, classification of markets based on market structure - Competition and its meaning, basic features of perfectly competitive and imperfect competitive markets. Characteristics of monopolistic competition, monopoly, duopoly, oligopoly, monopsony, duopsony and oligopsony with examples. Price determination under perfect competition – Equilibrium analysis - Numerical and graphical. Distribution theory - Meaning, factor market - Concepts of rent - Meaning, types of rent - Ricardian theory of rent. Wages - Meaning, nominal and real wages, working population in India - Labour participation rate, employment rate, unemployment rate - Interest- Meaning of interest and interest rate -Profit and income-Meaning, difference between income and profit. Pricing of factors of production -Modern theory of distribution. explanations. Public finance/ Public policy – Meaning, role and importance of public finance/Public policy - Functions of the government – Differences between public finance and private finance - Public revenue - Meaning, major and minor sources of public revenue. Tax – Meaning - Classification – Direct and indirect taxes, methods of taxation - Proportional, progressive, regressive and digressive taxation, agricultural taxation- VAT and GST.

### **UNIT – 4**

Canons of taxation–Adam Smith’s canons of taxation–Equality, economy, certainty and convenience – Other canons of taxation. Public expenditure–Meaning, need for public expenditure-Principles of public expenditure – Budget –Meaning -Balanced budget and deficit budget-Fiscal policy - Meaning and its policy instruments. National income accounting system–Meaning and importance, circular flow in the economy. Concepts of national income accounting - Gross domestic product, gross national product, net national product, net domestic product-National income at factor cost, personal income, disposable income, per capita income. Approaches to measurement of national income – Product method, income method, expenditure method and value-added method, difficulties in measurement. Trends in contribution of different sectors to GDP - Indian economy in the globalized world economy. Importance of population in the economy - Malthusian theory, escaping from the Malthusian stagnation- Innovations, technological transition and economic growth. Money - Meaning, evolution of money, functions of money, the money market -Types of demand and supply

of money in the economy. Credit - Meaning of credit, borrowing and lending, investments and their role in the modern economy - Credit controls and credit policy. Role of banking in the modern economy, functions of central bank and commercial banks, monetary policy and its instruments.

#### **UNIT – 5**

Types of inflation - Comprehensive and sporadic inflation – Suppressed and repressed inflation–Creeping, walking, running and galloping inflation–Markup inflation. General price index, wholesale price index, consumer price index-Rate of inflation – Measurement. Other causes of inflation–Remedial measures–Monetary and fiscal measures. Economic system - Meaning, importance of study of economy in systems approach -Types of economic systems. Capitalism-Meaning and its characteristic features, socialism and its characteristic features-Mixed economies and their characteristic features. Economic planning-Meaning, importance of planning in management of resources and institutions in the economy, elements of economic planning. Brief history of planning system in India- Annual plans, five-year plans meaning and objectives, role of planning commission of India and NITI Ayog.

#### Reference

1. Dewett, K.K. and Varma, J.D. 2003. *Elementary Economic Theory*. S. Chand and Co., New Delhi.
2. Dewett, K. and Chand, A. 2009. *Modern Economic Theory*. S. Chand and Co., New Delhi
3. Paul A. Samuelson and Nordhus. 2010. *Economics*. 19<sup>th</sup> Edition, Tata- McGraw Hill Education, New Delhi.
4. Jhingan, M. L. 1990. *Advanced Economic Theory*. Vikas Publishing House, New Delhi
5. Koutsoyiannis. 2015. *Modern Microeconomics*. Tata Mac-Graw Hill Publishers, New Delhi
6. *The Economy* 2016, [www.core-econ.org](http://www.core-econ.org).

Course Code A11181

**FUNDAMENTALS OF HORTICULTURE**

Credits 2(1+1)

#### **UNIT- 1**

Horticulture–Definition-Divisions of horticulture with suitable examples. Scope and importance of horticulture- Importance of horticulture in terms of income, employment generation, industry, religious, aesthetic, food & nutritive value and export. Horticultural classification based on soil, climate and botanical classification. Climate and soil for horticultural crops- Influence of

environmental factors on horticultural crop production—Temperature, humidity, wind, rainfall and solar radiation—Influence of soil factors—Soil type, pH, EC.

#### **UNIT- 2**

Propagating structures- Plant propagation -Methods-Sexual and asexual– Propagation by cuttings– Definition of cutting–Stem cuttings–Leaf cuttings– Root cuttings. Propagation by Layering -Types of layering (tip, simple, compound, mound, trench, air layering)-Natural modifications of layering (runners, suckers, stolon, offset) - Propagation by separation -Bulbs, corms; division (rhizome, stem tuber, tuberous roots). Grafting, budding- Root stock and scion selection–Grafting methods– Attached scion methods of grafting, simple or approach grafting, detached scion methods of grafting (side grafting-Veneer grafting, apical grafting-epicotyl grafting, double, soft wood grafting, cleft grafting, tongue grafting, whip grafting)-Graft incompatibility–Types–Translocated and localized incompatibility; Budding– Methods of budding–T-budding, inverted T-budding, patch budding and ring budding – Top working.

#### **UNIT- 3**

Principles of orchard establishment–Points to be kept in mind while electing site for the establishment of orchards - Principles and steps in orchard establishment-Layout of orchards– Systems of planting–Square, rectangle, quincunx, hexagonal and contour systems of planting-their merits and demerits. Principles and methods of training and pruning-Definition of training, objectives and training, principles and methods of training of fruit crops-Open centre, closed centre and modified leader systems their merits and demerits-Definition of pruning, objectives of pruning, principles and methods of pruning of fruit crops. Juvenility and flower bud differentiation–Methods for shortening juvenility- Application of growth regulators (Gibberellins, Auxins, cytokinins, Abscissic acid, Ethylene), environmental methods (photoperiod, temperature) - Cultivation techniques (grafting, pruning, girdling, irrigation, nutrition)-Bearing habits of fruit trees.

#### **UNIT- 4**

Unfruitfulness, factors (physiological, phylogenical, management, parasitical, climatological) pollination-Self and Cross pollination, pollinizers and pollinators - Fertilization and parthenocarpy – Types. Types of vegetables Gardens–Kitchen Garden, market garden, truck garden, vegetable forcing, garden for processing, seed production garden and floating garden. Ornamental garden types–Formal–Informal–Wild Garden–Parts/ features of an ornamental garden. Lawn making– Selection of Grass–Bermuda grass–Korean grass–Poa grass– Fescue grass–Kentucky blue grass-Grasses for shady areas–Site Selection–Soil -Preparation of soil–Drainage–Digging–Manuring and grading–Methods of planting–Sowing of seeds–Dibbling–Turfing–Maintenance of lawn–Mowing– Rolling – Sweeping –Scraping – Raking – Weeding – Irrigation – Top dressing with compost and fertilizers-Diseases and other problems–Fairy ring–Pale Yellow Laws.

#### **UNIT- 5**

Use of plant bio-regulators (PBR) in horticulture–Introduction–Applications of PBR in fruit crops. Irrigation methods in horticulture crops-Different methods followed in horticultural crops (check basin, furrow, ring basin, basin, flood, pitcher, funnel, drip and sprinkler). Fertilizer application-Different methods of application to horticultural crops- Broad casting, top dressing, localized placement, contact placement Band placement, row placement, pellet, foliar application, starter solution, fertigation.

*Practical*

1. Identification of garden tools.
2. Identification of horticultural crops.
3. Layout of different planting systems.
4. Layout of kitchen garden.
5. Preparation of nursery bed (raised and flat beds) and sowing of seeds.
6. Practice of different asexual methods by divisions.
7. Practice of different asexual methods by cuttings.
8. Practice of different asexual methods by grafting.
9. Practice of different asexual methods by budding.
10. Practice of different asexual methods by layering.
11. Training and pruning of fruit trees.
12. Transplanting and care of vegetable seedlings.
13. Making of herbaceous and shrubby borders.
14. Preparation of potting mixture, potting and repotting.
15. Fertilizer application in different crops.
16. Visits to commercial nurseries/orchard.

#### *References*

1. Chadha, K.L.2001. *Handbook of Horticulture*. ICAR, New Delhi.
2. Jitendra Singh, 2012. *Basic Horticulture*. Kalyani Publishers. New Delhi.
3. Randhawa, G.S. and Mukhopadhyaya, A. 1994. *Floriculture in India*. Allied Publishers Pvt. Ltd., New Delhi
4. Kumar, N. 1997. *Introduction to Horticulture*. Rajyalakshmi Publications, Nagorcoil, Tamilnadu.

Course Code A11190

HUMAN VALUES AND ETHICS\*

Credits 1(1+0)

#### **UNIT- 1**

Universal human aspirations, happiness and prosperity. Human values and ethics-Concept, definition, significance and sources-Fundamental Values-Right conduct, peace, truth, love and non-violence. Principles and philosophy–Self exploration, self-awareness, self-satisfaction, decision making, motivation, sensitivity, success, selfless service. Case study of ethical lives.

#### **UNIT- 2**

Positive spirit, body, mind and soul-Attachment and detachment. Spirituality and spirituality quotient. Examinations.

#### **UNIT- 3**

Ethics-Professional, environmental, ICT-Sensitization towards others particularly senior citizens, developmentally challenged and gender. Positive attitude and scientific temper. Team work and volunteering.

#### **UNIT- 4**

Rights and responsibilities. Road safety. Human relations and family harmony, modern challenges and value conflict.

#### **UNIT- 5**

Sensitization against drug abuse and other social evils. Developing personal code of conduct (SWOT/SWOC/SNAC Analysis). Management of anger and stress.

## References

1. Gaur RR, Sangal R and Bagaria GP. 2011. *A Foundation Course in Human Values and Professional Ethics*. Excel Books.
2. Mathur SS. 2010. *Education for Values, Environment and Human Rights*. RSA International.
3. Sharma RA. 2011. *Human Values and Education—Axiology, Incultation and Research*. R. Lall Book Depot.
4. Sharma RP and Sharma M. 2011. *Value Education and Professional Ethics*. Kanishka Publishers.
5. Srivastava S. 2011. *Human Values and Professional Ethics*. SK Kataria and Sons.
6. Srivastava S. 2011. *Environmental Science*. SK Kataria & Sons.
7. Tripathi A.N. 2009. *Human Values*. New Age International(P) Ltd Publishers.
8. R.S. Nagarajan. *Text Book on Professional Ethics & Human Values*.
9. D.R. Kiran. *Professional Ethics & Human Values*
10. Virendra Kumar. *Human Values and Professional Ethics*.
11. M. Govindarajan. *Engineering Ethics*.

Course Code A11191

RURAL SOCIOLOGY AND  
EDUCATIONAL PSYCHOLOGY

Credits 2 (1+1)

### UNIT- 1

Sociology and Rural Sociology- Meaning, definition, scope, its significance in Agricultural Extension- Importance of Rural Sociology in Agricultural Extension and their interrelationship. Indian rural society- Characteristics, differences and relationship between rural and urban society. Social group(s) – Meaning, definition, classification, factors to be considered in formation of groups-Role of social groups in Agricultural Extension. Social Stratification– Meaning, definition, bases and forms of social stratification, characteristics and differences between class system and caste system.

### UNIT- 2

Different cultural concepts- Culture, tradition, customs, folkways, mores, taboos, ritual- Definition, meaning, concept and examples and their role in Agricultural Extension. Social values- Meaning, definition and types; social control- Meaning, definition, need of social control and means of social control and attitudes- Types and their role in Agricultural Extension. Social institution– Types– Family, education, religious, economic (Co-operative society) & political (Panchayat)- Characteristics, functions and their importance/ role in Agricultural Extension.

### UNIT- 3

Social change- Meaning, definition, nature of social change, dimensions of social change and factors of social change & development. Psychology and educational psychology- Meaning, definition, scope and its importance in Agricultural Extension– Behavior-

Cognitive, affective and psychomotor domains. Intelligence-Meaning, types, factors and importance in Agricultural Extension.

#### **UNIT- 4**

Perception-Meaning, types, factors and importance in Agricultural Extension. Emotions and frustration-Meaning, types, factors and importance in Agricultural Extension. Personality-Meaning, definition, types, factors influencing personality and importance in Agricultural Extension.

#### **UNIT- 5**

Motivation-Meaning, types of motives, theories of motivation and importance of motivation in Agricultural Extension. Teaching, learning, learning experience, learning situation Meaning and definition, elements of learning situation and its characteristics. Principles of learning, their implications in teaching and steps in extension teaching.

#### *Practical*

1. Visit to village to study the characteristics of rural society and rural stratification.
2. Visit to village to study the social groups.
3. Visit to village to study the village institution –School.
4. Visit to village to study the village institution–Cooperative society/ Bank.
5. Visit to village to study the village institution–Gram Panchayat.
6. Visit to village to study the social organization-Youth Club/ Rytu Mitra group.
7. Visit to village to study the social organization-Milk Co-operative centre/ Dairy unit.
8. Visit to village to study the social organization- Water User Association/ Self Help Group.
- 9&10 Visit to a village to list out the customs- Folkways, mores, taboos, rituals and social values- Simulated exercises on perception of students.
11. Simulated exercises for positive and negative emotions of students.
12. Nature of learners behavior in motivation.
13. &14.Administering psychological tests to assess personality types of human beings. Experiment: 1. Eysenk personality inventory Administering psychological tests to assess personality types of humanbeings.2.Edward' spersonality inventory.
15. To study the types of intelligence among students.
16. Creating a learning situation under village conditions with a selected technology.

#### *References*

1. Adivi Reddy, A. 2006. *Extension Education*. Sree Lakshmi Press, Bapatla
2. Chitamber, J. B. 1997. *Introductory Rural Sociology*. Wiley Eastern Limited, New Delhi
3. Daivadeenam, P. 2006. *Educational Psychology in Agriculture*. Agrotech Publishing



Academy, Udaipur

4. Mangal, S. K. 2000. *Educational Psychology*. Prakash Brothers, Ludhiana.
5. Ray, G.L. 2006. *Extension Communication and Management*. Naya Prokash/ Kalyani Publishers, Ludhiana
6. Vidya Bhushan and Sach Dev.D.R. 1998. *An Introduction to Rural Sociology*. Kitab Mahal Agencies Allahabad.

Course Code A11020

ELEMENTARY MATHEMATICS

Credits 2(1+1)

### UNIT- 1

Definition of matrices, order of a matrix- Type of matrices-Addition-Subtraction - Multiplication - Transpose of matrix -Minor. Define Co-factor of matrix – A Inverse matrix upto 3<sup>rd</sup> determinants and properties of determinants upto 3 rule and order and their evaluation - Cramer's simple problems based on it. Definition of function – Limit and continuity with simple problems. Differentiation of  $x^n$ - $e^x$ - $\sin x$  and  $\cos x$  by first principle – Derivatives of sum – Difference product and quotient of two functions – Differentiation of functions of functions (Simple problems based on it).

### UNIT- 2

Logarithmic differentiation (simple problems based on it) - Differentiation by substitution (simple problems) – Differentiation of inverse trigonometric functions - Equations of tangent- Normal of given curve at given point. Define Maxima and Minima with simple problems. Integration of functions – Integration of product of two functions – Integration by substitution method.

### UNIT- 3

Definite Integral (simple problems based on it) – Area under simple well-known curves (simple problems based on it). Introduction to Co-ordinate geometry and give distance formula – Section formula with examples. Define straight line and write different types of straight line forms with examples. Solve the angles between two straight lines – Area of triangle and quadrilateral.

### UNIT- 4

Definition of standard and general equation of circle – Equation of circle passing through three given points. Tangent and normal to a given circle at given point (simple problems) - Condition of tangency of a line to circle. Definition of general and standard equations of parabola-Vertex-Focus-Equation of directrix - Length of latus rectum.

### UNIT- 5

Equation of tangent and normal to a given point (simple problems)- Conditions of tangency of line  $y=mx+cy^2=4ax$ . Define standard form of the ellipse. Focus–Directrix-Vertex of the ellipse in both cases ( $a>b$ ,  $b>a$ ). Equation of tangent-Normal at given points to a given ellipse with problems.

### Practical

- 1 Problems on Addition-Subtraction-Multiplication-Transpose of matrix 3<sup>rd</sup> order.
- 2 Problems on minor-Co-factor of matrix-Inverse of matrix upto 3<sup>rd</sup> order.
- 3 Cramer's rule and simple problems based on it and problems on determinants.

- 4 Function limit and continuity with simple problems.
- 5 Problems on differentiation of  $x^n$ - $e^x$ -  $\sin x$  and  $\cos x$  by first principle.
- 6 Derivatives of sum – difference product and quotient of two functions – Differentiation of functions of functions – Simple problems based on it.
- 7 Logarithmic-Inverse-Trigonometric functions- Functions of functions - Equations of tangent- Normal of given curve at given point- Simple problems.
- 8 Problems on integration of functions – Integration of product of two functions- Integration by substitution method.
- 9 Integral (simple problems based on it)- Area under simple well –known curves (simple problems based on it).
- 10 Problems on different types of straight line forms.
- 11 Problems on angles between two straight lines – Area of triangle and quadrilateral.
- 12 Problems on equation of circle passing through three given points.
- 13 Problems on parabola–Vertex–Focus-equation of directrix-Length of lotus rectum.
- 14 Problems on equation of tangent and normal to a given point-Conditions of tangency of line  $y = mx + c$  to  $y^2 = 4ax$
- 15 Problems on standard form of the ellipse-Focus–Directrix-Vertex of the ellipse in both cases ( $a > b$ ,  $b > a$ ).
- 16 Equation of tangent –Normal at given points to a given ellipse-Simple problems.

#### References

1. MVSLDN Raju and Dr.K.V.Ramana– *Engineering Mathematics-1*
2. MVSLDN Raju and Dr.K.V.Ramana– *Engineering Mathematics-2*
3. *Text Book for A.P Intermediate Mathematics–Paper (IA&IIB).*
4. MVSLDN Raju and K.V.Ramana –*Agricultural Mathematics.*

Course Code A11021 IT **WORKSHOP** Credits 1(0+1)

#### Week 1 :

**Task 1:** Identify the peripherals of a computer, components in a System Cabinet and its functions. Draw the block diagram of the computer mother board along with the configuration of each peripheral and submit to your instructor.

#### Week 2:

**Task 2:** Every student should disassemble and **assemble the PC back to working condition.** Lab instructors should verify the work and follow it up with a Viva. Also students need to go

through the video which shows the process of assembling a PC. A video would be given as part of the course content.

### **Week 3:**

**Task 3 :**Every student should individually install Operating System on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

### **Week 4:**

**Task 4:** Every student should configure dual boot system. Lab instructors should verify the installation and follow it up with a Viva

### **Week 5 :**

**Task 5: Orientation & Connectivity Boot Camp :**Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email.

### **Week 6:**

**Task 6: Search Engines & Netiquette:** Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

### **Week 7 and Week 8:**

**Task 7:** Features of Word Processor Tool: Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track changes.

**Task 8:** Creating a Newsletter: Features: Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge.

### **Week 9 and Week 10:**

**Task 9:** Features of Spread sheet Tool: Creating a Scheduler - Features:- Gridlines, Format Cells, Summation, auto fill, Formatting Text

**Task 10:** Calculating GPA : Cell Referencing, Formulae in spread sheet – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, lookup, Sorting, Conditional formatting.

**Week 11 and Week 12:**

**Task 11:** Features of Presentation tool: Students will work on basic power point utilities and tools which help them to create power point presentation.

**Task 12:** Presentation Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks, Inserting – Images, Clip Art, Audio, Video, Objects, Tables and Charts Lines and Arrows

**Week 13:**

Document preparation using LaTeX

**Week 14 and Week 15:**

Review of Previous tasks

**Note:** Document, Spread Sheet and Presentation Tools, are from Libre Office suite

**REFERENCES:**

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dream tech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dreamtech
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. PC Hardware and A+ Handbook – Kate J. Chase PHI (Microsoft)
5. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
6. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan – CISCO Press, Pearson Education.

**COMPREHENSION AND COMMUNICATIONS SKILLS IN ENGLISH****UNIT- 1**

War minus shooting—A lesson from the text book “The Sporting Spirit” by George Orwell—Comprehension pertaining to the textual grammar- Fill in the blanks, matching and vocabulary. Synonyms- List of synonyms – Choose the synonyms- Exercises- Practice and implementation. Antonyms— Fill in the blanks- Choose the correct antonyms- Exercises Practice and implementation. Verbal ability— A list of words of ten confused and misused- Practice and implementation.

**UNIT- 2**

A Dilemma—A lesson from the textbook, “Layman looks at Science” by Raymond B. Fosdick - Comprehension pertaining to the textual Grammar - Fill in the blanks, matching, vocabulary and reading comprehension. A Dilemma— A Layman looks at Science- Reading comprehension and answering the questions. Homonyms – Homonyms are distinct words with quite different meanings using the words in two ways – More words at a glance and exercises related to GRE and TOEFL.

**UNIT- 3**

Homophones— A list of homophones- Fill in the blanks, underline the correct word and exercises related to GRE and TOEFL. You and Your English— A lesson from the textbook, ”A Spoken English and Broken English “by G. B. Shaw – Answering the questions related to the text – Fill in the blanks, matching and vocabulary and reading comprehension. You and Your English—Reading comprehension and answering the questions.

**UNIT- 4**

Functional Grammar— Tenses – Active voice and passive voice – Degrees of comparison and types of sentences – Direct and indirect speech and agreement of verb with subject functional grammar – Articles – Prepositions- Parts of speech and agreement verb with subject -Glossary. Business correspondence- Principles of letter – Writing - Courtesy and consideration- Directness and conciseness, avoid– Verbosity and participial endings- Clarity and precision- Negative and roundabout- Structure and layout Of letters- Planning a letter quotation, orders, tenders, sales letters, claim and adjustment letters, job application letters- Social correspondence— Personal correspondence and curriculum vitae. The style- Importance of professional writing- Choice of words and phrases, clichés - Jargons - Foreign words and phrases.

**UNIT- 5**

Precise writing- Summarizing— The essential features of a good precise— Important points while making a precise- Some don'ts- Make a precise of the following paragraph and suggest suitable title- Figurative language—Figurative language associated with literature and with poetry- The figures of speech usually used in writing and conversation. Interviews— The screening interview- The informational interview- The directive style- The meandering style- The stress interview-The behavioral interview- The audition- The TagTeam interview- The mealtime interview- The follow– up interview- Fermi interview- Preparing for the interview- Body language and interview-Types of interview questions- Idiomatic language.

### Practical

1. Effective listening– Developing listening skills–Honing listening skills.
2. Listening to short talks and lectures from the cassettes of EFL University.
3. Spoken english– Vowels–Consonants- Monophthongs, diphthongs, triphthongs.
4. Stress – Intonation – Phonetic transcription.
5. Seminars–Conferences-Preparation and demonstration.
6. Oral presentation by students- Articulation and delivery–Evaluation sheet for oral presentation.
7. Communication skills–Verbal communication- Written communication.
8. Telephonic conversation.
9. Reading skills- Skimming, scanning- Extensive reading- Intensive reading and examples.
10. Meeting- Purpose, procedure, participation, physical arrangements.
11. Presentation of reports by using PowerPoint and L.C.D.
12. Interviews – Mock interviews.
13. Debate and Group discussion.
14. Using a dictionary effectively.
15. Vocabulary.
16. Pronunciation practice.

### References

1. Balasubramanian, T. 1989. *A Text Book of Phonetics for Indian Student*, Orient Longman, New Delhi.
2. Balasubramanyam, M. 1985. *Business Communication*. Vani Education Books, New Delhi.
3. Jean Naterop, B. and Rod Revell. 1977. *Telephoning in English*. Cambridge University Press, Cambridge.
4. Krishna Mohan and Meera Banerjee. 1990. *Developing Communication Skills*. Mc Millan India Ltd. New Delhi.
5. Krishanswamy, Nand Sriraman, T. 1985. *Current English for Colleges*. McMillan India Ltd., Madras.
6. Narayanaswamy VR. 1979. *Strengthen Your Writing*. Orient Longman, New Delhi.
7. Sharma RC and Krishna Mohan. 1978. *Business Correspondence*. Tata McGraw Hill Publishing Company, New Delhi.

**UNIT- 1**

Introduction and basic components of NSS – Orientation - History, objectives, principles, symbol, badge; regular programs under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health. NSS 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 mobilization - Mapping of community stake holders, 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 innation building, conflict resolution and peace-building. 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 rightsto information.

**UNIT- 2**

Family and society - Concept of family, community (PRI s and other community based organisations) and society. Importance and role of youth leadership - Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership. Life competencies - Definition and importance of life competencies, problem- solving and decision - making, inter personal communication. Youth development programmes- Development of youth programmes and policy at the national level, state level and voluntary sector; youth - focused and youth - led originations. Health, hygiene and sanitation - Definition needs and scope of health education; role of food, nutrition, safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health. Youth health, life style, HIV AIDS and first aid - Healthy life styles, HIV AIDS, drugs and substance abuse, home nursing and first aid.

**UNIT- 3**

Youth and yoga - History, philosophy, concept, myths and mis conceptions about Yoga; yoga traditions and its impacts, yogaas a tool for healthy life style, preventive and curative method Vocational skill development - To enhance the employment potential and to setup small business enterprises skills of volunteers, A list of 12 to15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list. Issues related environment - Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management. Disaster management - Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

#### **UNIT- 4**

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 Youth and crime-Sociological and psychological factors influencing youth crime, Cyber - crime, peer mentoring in preventing crime and awareness for juvenile justice Civil / self defence - Civil defence services, aims and objectives of civil defence; Needs and training of self defence.

#### **UNIT- 5**

Resource mobilisation - Writing a project proposal of self -fund units (SFUs) and its establishments Additional life skills - Positive thinking, self -confidence and esteem, setting life Goals and working to achieve them, management of stress including time Management. I year B.Sc. (Hons) Agriculture –II Semester

Course Code A12103

### **INTRODUCTORY AGRO METEOROLOGY AND CLIMATE CHANGE**

Credits2 (1+1)

#### **UNIT- 1**

Introduction: The three spheres of the earth; Terminology and definitions: Meteorology, Climatology, Agro meteorology, Agro climatology climate and weather. Scope and importance of agro meteorology. Agroclimatic regions of India and Agro climatic zones of Andhra Pradesh. Atmosphere - Composition of the atmosphere - Weather elements - Extent and structure of the atmosphere. Solar Radiation: Nature and properties of solar radiation- Conduction – Convection- Radiation - Solar Spectrum - Distribution of solar radiation within the crop canopies - Physiological response of different bands of incident radiation - Definitions of solar constant, net radiation, albedo - Solar radiation and crops.

#### **UNIT- 2**

Temperature: Temperature and heat, definitions - Temperature inversion - Adiabatic lapse rate - Daily and seasonal variations of temperature – Vertical profile of temperature - Energy balance of earth. Low air temperature and plant injury and high air temperature and plant injury - Soil temperature - Factors affecting soil temperature - Temperature and crops. Humidity: Concept of saturation – Vapour pressure - Types of humidity - Humidity and crops- Atmospheric Pressure: Definitions of pressure, atmospheric pressure, standard atmospheric pressure.

#### **UNIT- 3**

Wind: Types of wind; Planetary winds (trade winds, westerlies, polar easterlies, cyclones and anti cyclones) periodic winds and local winds (sea and land breezes, mountain and valley winds) Daily and seasonal variation of winds - Effect of wind on crops. Precipitation: Process of precipitation, types of rainfall (orographic, convectional and cyclonic) - Definition of cloud – WMO classification of clouds. Forms of precipitation (solid, liquid and mixed) and condensation (dew, fog, mist, frost, cloud) - Artificial rain making - Monsoon: Indian monsoons, SW monsoon & NE monsoon.



#### UNIT- 4

Importance of monsoon in Indian agriculture - date of onset, significant features of Indian monsoon; length of growing season. Weather hazards: Drought - Floods - Cyclones - Heat and cold - waves and their management. Weather Forecasting: Importance - Types of weather forecast and their uses - Synoptic charts - Remote sensing - Applications of remote sensing in agriculture- Agro meteorological Advisory services in India.

#### UNIT- 5

Climate change - variability - Global processes and effects - Greenhouse effect - Temperature changes on the earth - Precipitation changes on the earth - Changes in extreme events - Sea level raising - Tracking climate change - Impacts of climate change on agriculture - Climate neutral. Summary of evidence for climate change - Basic models for evaluating climate change Impacts- Specific weather related effects due to climate change. Micro climate - micro climate scales – Modifications of crop micro climate - Examples of manipulation of climate - Climatic normals for crop and livestock production.

#### *Practical*

1. Visit to Agro meteorological Observatory, site selection and layout plan for observatory.
2. Exposure to agro meteorological instruments and weather data recording.
3. Measurement of total, shortwave and long wave radiation and its estimation by using Planck's intensity law.
4. Measurement of albedo and sunshine duration.
5. Computation of radiation intensity using bright sun shine hours.
6. Measurement of maximum and minimum air temperatures.
7. Measurement of soil temperature and computation of soil heat flux.
8. Determination of atmospheric pressure and vapour pressure.
9. Determination of relative humidity.
10. Determination of dew point temperature.
11. Measurement of wind speed and wind direction.
12. Measurement, tabulation and analysis of rainfall data.
13. Measurement of open pan evaporation and evapo-transpiration. Computation of PET and AET
14. Preparation of synoptic chart and report
15. Computation of climate change and variability
16. GDD, HTU and PTU calculations and their interpretation using their efficiencies

#### *References*

1. Radha Krishna Murthy, V.2016. Principles and practices of agricultural disaster management. B.S Publications, Koti, Hyderabad.
2. Reddy, S.R.2014. Introduction to Agriculture and Agro meteorology. Kalyani Publishers, Ludhiana, Punjab.
3. Radha Krishna Murthy, V. 2002. Basic Principles of Agricultural meteorology .BPublications, Koti, Hyderabad.

## INTRODUCTION TO FORESTRY

Course Code A12104

Credits 2(1+1)

### UNIT- 1

Introduction–definitions of basic terms related to forestry, Indian forest, target area, productivity Influence of forest on climate, soil, floods, erosion, human health and recreation. Objectives of silviculture, forest classification, salient features of Indian forest policies. Forest regeneration, Natural regeneration- natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers.

### UNIT- 2

Artificial regeneration –objectives, choice between natural and artificial regeneration, planting methods, essential preliminary considerations. Crown classification. Tending operations–weeding, cleaning, thinning–mechanical, ordinary, crown and advance thinning. Principles and practices of social forestry nurseries- types of nurseries- success in nursery production.

### UNIT- 3

Afforestation in different sites- shiftings and dunes, saline soils, ravine and, wet lands, lateritic soils, dry rocky soils, canal banks, road sides and water shed areas. Village wood lots, selection of species – measures for shortage of fuelwood- Properties of fuel wood – management and advantages of energy plantations- Suitable trees species. Forest mensuration–objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement- shadow and single pole method.

### UNIT- 4

Instrumental methods of height measurement – geometric and trigonometric principles, instruments used in height measurement. Tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees. Major and minor forest products.

### UNIT- 5

Agroforestry–definitions, importance, criteria of selection of trees in agroforestry. Different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of Subabul, Eucalyptus and Casuarina tree species.

#### *Practical*

1. Identification of tree-species.
2. Diameter measurements of trees
3. Height measurement of standing trees
4. Volume measurement of trees
5. Biomass estimation in energy plantations
6. Nursery lay out, seed sowing,
7. Application of pre-sowing seed treatments
8. Vegetative propagation techniques.
9. Field planting techniques
10. Forest plantations and their management.

11. Identification of important major and minor forest products
12. Visits of nearby forest based industries.
13. Visit to social nurseries of forest department
14. Visit to energy plantations and forest research centres.
15. Visits to nearby forest based industries.
16. Collection and maintenance of forest products and herbarium.

### References

1. Dwivedi, A.P. 1980. Forestry in India, Jugal Kishore and Company, DehraDun
2. Negi, S.S. 1999. Agroforestry hand book, International book distributor, DehraDun.
3. Ram Prakash and Drake Hocking. 1986. Some favourite trees for fuel and fodder, International book distributor, Dehradun.
4. Singh, S.P. 2009. Tree farming-. Agrotech Publishing academy, Udaipur.
5. Singh, S.P. 2010. Favourite Agro forestry trees, Agrotech Publishing academy, Udaipur.
6. Troup, T.S. 1986. Silviculture of Indian trees (Vol. II & III)-International book distributor, Dehradun.

Course Code A12121

**FUNDAMENTALS OF SOIL SCIENCE**

Credits 3(2+1)

### UNIT- 1

Introduction- Spheres of the earth atmosphere, hydrosphere and lithosphere– Their characteristics–Origin of soil–Soil and soil components–Mineral matter, organic matter, water and air–Definition of soil and various concepts of soil– Branches of soil science. Rocks–Classification of rocks based on mode of origin– Igneous rocks, sedimentary rocks and metamorphic rocks– Classification of rocks based on silica content–Weatherability of rocks. Minerals–Primary, secondary, essential and accessory minerals–Primary minerals. Quartz, feldspar, micas, pyroxenes, amphiboles and olivines– Weatherability of primary minerals. Non-silicate minerals– P, Ca, Mg, S and micronutrient containing minerals–Secondary silicate minerals–Basic structural units. Weathering–Types of weathering– Physical weathering of rocks–Agents of physical weathering and their role- Biological weathering– Role of flora and fauna in weathering process. Chemical weathering–Solution, hydration, hydrolysis, carbonation, oxidation and reduction.

### UNIT- 2

Parent material–Classification of parent materials based on their mode of transport by different agents- Soil formation– Soil forming factors– Classification and their role in soil formation– Catena–Definition. Pedogenic processes–Eluviation, illuviation, humification, calcification, laterization, podzolisation, melanisation, salinization and alkalization. Soil profile–Detailed description of a theoretical soil profile– Differences between surface soil and subsoil. Soil physical properties– Soil texture–Definition–Various inorganic components in soil and their properties–Various textural classes in soil and their properties. Particle size analysis– Stoke’s Law–Assumptions and limitations– significance of soil texture. Soil consistence– Consistence of wet and dry soils– Soil crusting–Soil plasticity– Atterberg’s plastic limits– Factors affecting plastic limits–Significance of soil consistence.

### **UNIT- 3**

Soil structure–Classification–Types, classes and grades of soil structure– Importance of soil structure and its management. Soil density–Bulk density and particle density–Factors affecting density parameters–Importance of bulk density of soil–Soil compaction–its importance. Calculation of porosity. Soil strength and its importance–Soil colour–Components–Significance of soil colour. Soil water–Forces of soil water retention–pF concept–Soil moisture characteristic curves–Importance of soil water. Soil water potential–Components of water potentials–Soil moisture constants– Field capacity, wilting coefficient, hygroscopic water and saturation–Available water and methods for determining soil moisture constants–Pressure plate and pressure membrane apparatus. 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.

### **UNIT- 4**

Soil temperature– Sources of heat–Heat capacity and conductivity–factors influencing soil temperature–Modification of soil thermal regimes–Measurement of soil temperature–Importance of soil temperature on crop growth–Management of soil temperature and importance. Soil air–Compositions of atmospheric air 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. Soil reaction, pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability. Soil colloids– Definition–General properties–Shape, surface area, electrical charge, adsorption, flocculation, deflocculation, plasticity, cohesion, swelling, shrinkage, Tyndall effect and Brownian movement. Secondary silicate clay minerals of different types–Kaolinite, illite, montmorillonite and chlorite–Properties–Allophanes. Origin of charge in organic and inorganic colloids–Negative and positive charges. Differences between organic and inorganic soil colloids.

### **UNIT- 5**

Adsorption of ions–Types of ion exchange–Cation and anion exchange–Cation and anion exchange capacities of soil–Base saturation–Factors affecting ion exchange capacity of soils–Importance of Cation Exchange Capacity (CEC) of soils. Calculation of base exchange capacity and exchangeable acidity. Soil biology–Biomass–Flora and fauna–Their important characteristics–Role of beneficial organisms–Organic matter decomposition, mineralization and immobilization. Nitrogen fixation, denitrification, solubilization of phosphorus and biological control of plant diseases–Promotion of plant growth promoting substances–Harmful activities of soil organisms. Soil organic matter–Various sources–Composition–Compounds in plant residues. Their decomposability–Humus–Definition–Synthesis of humus. Soil organic matter and humus–Importance–Fractionation of soil humus–Carbon cycle–Carbon: nitrogen(C:N) ratio of commonly available organic residues– Significance of C:N ratio in soil fertility. Soil classification–Early system of soil classification–Diagnostic horizons. Soil taxonomy–Order, suborder, great group and family series–Nomenclature according to soil taxonomy. Soil groups of India–Alluvial soils, black soils, red soils, laterite soils and coastal sands.

### Practicals

1. Methods of chemical analysis, principles, techniques and calculations
2. Study of soil sampling tools, collection of representative soil sample, its Processing and storage.
3. Description of soil profile in the field.
4. Studies of capillary rise phenomenon of water in soil column and water movement in soil.
5. Determination of texture by feel method.
6. Determination of mechanical composition of soil using Bouyoucos Hydrometer.
7. Determination of bulk density and particle density of soil and porosity.
8. Determination of soil moisture content by gravimetric method.
9. Determination of infiltration rate.
10. Determination of soil strength by cone penetrometer.
11. Aggregate analysis by wet sieving method.
12. Determination of soil pH & EC of soil.
13. Determination of cation exchange capacity of soil.
14. Determination of soil colour & study of soil map.
15. Estimation of organic matter content in soil.
16. Determination of heat transfer in soils.

### References

1. Indian Society of Soil Science. 2012. *Fundamentals of Soil Science*, IARI, New Delhi.
2. Das, D.K. 2015. *Introductory Soil Science*, 4<sup>th</sup> Edition, Kalyani Publishers, New Delhi
3. Sehgal, J. 2015. *A Text Book of Pedology*– Concepts and Applications, Kalyani Publishers, New Delhi.

ENTO A12131

### **FUNDAMENTALS OF ENTOMOLOGY (INSECT MORPHOLOGY & TAXONOMY)**

3(2+1)

#### **UNIT- 1**

History of Entomology in India - Contributions of eminent entomologists - Locations and year of establishment of entomological institutions - Arthropoda – Mention of insects in scripts – Contributions of Aristotle, J.C. Fabricius, J.G. Koenig, Carolus Linnaeus, Cramer, Dury, Dr. Kerr, Rev Hope Rothney, Ronald Ross, L De Niceville, H.M Lefroy, T.B.Fletcher, E.P. Stebbing, T.V. Ramakrishna Ayyar, B.V. David, Y.Ramachandra Rao, M S Mani, S Pradhan, H.S. Pruthi, M.R.G.K. Nair and S. Pradhan; ML Roonwal, T.Kumara Swami, M R G K Nair, K.K. Nayar and N. Ananthakrishnan - Locations and year of establishment of Division of Entomology, IARI, Zoological Survey of India (ZSI), Directorate of Plant Protection, Quarantine and Storage (DPPQS), Indian Institute of Natural Resins and Gums (IINRG), National Bureau of Agricultural Insect Resources (NBAIR), National Institute of Plant Health Management (NIPHM), National Centre for Integrated Pest Management (NCIPM) and Forest Research Institute (FRI). Contributory

factors for abundance of insects – Major structural characters, developmental characters and protective characters (Morphological, physiological, behavioural and construction of protected niches) of Insecta in Animal Kingdom. Classification of Phylum Arthropoda up to Classes – Different Classes of Arthropoda and comparison of characters of Class Insecta with Arachnida, Crustacea, Symphyla, Chilopoda, Diplopoda and Onychophora; Structure and functions of body wall and moulting – Different layers, chemical composition, functions of body wall and cuticular appendages – Cuticular processes and cuticular invaginations – Chaetotaxy – Moulting – Apolysis, ecdysis and sclerotization. Body segmentation of the insects – Head (Syncephalon) – Procephalon and gnathocephalon, types of head, sclerites and sutures of insect head - Thorax – Segments and appendages (wings and legs). Abdomen – Segments, pre and post genital appendages (Furcula, cornicles, tracheal gills and pseudo ovipositor in Diptera - Propodeum, petiole and gaster in Hymenoptera) - Male and female genital organs - Epimorphic and anamorphic development in insects.

## **UNIT- 2**

Antenna – Structure of typical antenna and its modifications in different insects with examples. Mouthparts – Biting and chewing, sucking (Piercing and sucking, Rasping and sucking, Chewing and lapping, Sponging and Siphoning/ Simple sucking), mask and degenerate types with examples. Legs – Structure of a typical insect leg and modifications of insect legs with examples, Wings – Venation, margins and angles – Types of wings and wing coupling organs with examples. Types of Metamorphosis and diapause – Metamorphosis- Ametamorphosis- Incomplete Metamorphosis or Direct or Simple Metamorphosis- Intermediatemetamorphosis - Complete Metamorphosis or Complex or Indirect Metamorphosis- Hypermetamorphosis with examples - Diapause- Obligate and facultative diapause – Stage of occurrence of diapause with examples. Types of larva and pupa – Differences between nymph and larva - Larva- Protopod- Oligopod (Campodeiform and Scarabaeiform)- Polypod and Apodus with examples - Pupa- Obtect- Exarate- Coarctate- Chrysalis with examples.

## **UNIT- 3**

Digestive system – Alimentary canal – Structure of foregut, midgut and hindgut – histology, functions, filter chamber and peritrophic membrane – Process of digestion- Extra intestinal digestion. Circulatory system – Open and closed types – Organs of circulatory system – Dorsal blood vessel (diaphragms, sinuses and accessory pulsatile organs) – Process of circulation - Types of haemocytes – Properties and functions of haemolymph. Excretory system – Structure, functions and modifications of malpighian tubules → Structure and functions of other organs of excretion. Respiratory system – Tracheal system – Structure of spiracle and trachea – Classification based on functional spiracles and other means of respiration. Nervous system – Neuron and its types (based on structure and function) – Synapse, ganglia, central nervous system, sympathetic nervous system and peripheral nervous system. Reproductive system – Structure of male and female reproductive systems – Structure and types of ovarioles and structure of follicle – Types - Special modes of reproduction in insects.

## UNIT- 4

Secretory (endocrine) system – Structure and functions of neurosecretory organs (neurosecretory cells of brain, corpora cardiaca, corpora allata, prothoracic glands and ring gland). Sense organs – Compound eyes – Structure of ommatidium – Ocelli – Dorsal ocelli and lateral ocelli - Types of images and auditory organs (auditory hairs, tympanum, Johnston's organ and pilifer organ) – Chemoreceptors. Taxonomy – Importance - History – Binomial nomenclature - Holotype, allotype and paratype – Suffixes of tribes, subfamily, family and superfamily – Law of priority – Synonyms and homonyms - Definitions of biotype - Subspecies - Species – Genus - Family and Order. Characters of Class Insecta - Economic classification of insects- Classification upto Orders – Subclasses - Apterygota and Pterygota– Names of Orders of Apterygota and Pterygota with examples - Orthopteroid, Hemipteroid and Panarpooid group of orders. Orthoptera – General characters - Gryllidae, Acrididae, Tettigonidae and Gryllotalpidae – Characters with examples. Dictyoptera – General characters – Blattidae and Mantidae– Characters with examples - Odonata - General characters with examples. Isoptera – General characters –Termitidae – Characters with examples - Order – Thysanoptera – General characters –Thripidae – Characters with examples. Hemiptera – General characters - Sub order Heteroptera – Characters - Cimicidae - Miridae, Pentatomidae, Lygaeidae, Coreidae, Pyrrhocoridae - Characters with examples. Hemiptera - Suborder Homoptera – Characters – Delphacidae, Cicadellidae, Aleurodidae, Aphididae, Coccidae, Pseudococcidae, Lopophidae- Characters with examples -Neuroptera – General characters - Chrysopidae- characters with examples.

## UNIT- 5

Lepidoptera-General characters - Differences between moths and butterflies - Noctuidae, Lymantriidae and Sphingidae and Pieridae- Characters with example. Lepidoptera-General characters - Pyralidae, Crambidae, Gelechiidae, Lycaenidae, Arctiidae, Papilionidae, Saturniidae and Bombycidae - Characters with examples. Coleoptera - General characters – Scarabaeidae, Coccinellidae, Chrysomelidae, - Characters with examples. Coleoptera - General characters – Cerambycidae, Bruchidae, Apionidae and Curculionidae - Characters with examples. Hymenoptera - General characters – Tenthredinidae, Ichneumonidae, Braconidae, Chalcididae, Trichogrammatidae, and Apidae- Characters with examples. Diptera -General characters - Culicidae, Cecidomyiidae, Muscidae, Tachinidae, Agromyzidae and Tephritidae - Characters with examples.

## Practical

- 1 Methods of collection and preservation of insects including immature stages.
- 2 External features of Grasshopper / Blister beetle.
- 3 Study of types of mouthparts – Biting and chewing, piercing and sucking, rasping and sucking, chewing and lapping, sponging and siphoning.
- 4 Study of different types of insect antennae and legs.
- 5 Study of wing venation, types of wings and wing coupling mechanisms.
- 6 Study of different types of insect larva and pupa.

- 7 Dissection of digestive system in insects (Grasshopper).
- 8 Dissection of female and male reproductive systems in insects (Grasshopper).
- 9 Study of characters of Orders - Orthoptera, Dictyoptera and their families and Odonata.
- 10 Study of characters of Orders - Isoptera and Thysanoptera and their families.
- 11 Study of characters of Orders -Hemiptera and its sub order Heteroptera and their families.
- 12 Study of characters of Sub Order - Homoptera and its families.
- 13 Study of characters of Order- Neuroptera and Lepidoptera and their families.
- 14 Study of characters of Order- Coleoptera and its families.
- 15 Study of characters of Order- Hymenoptera and its families.
- 16 Study of characters of Order - Diptera and its families.

### References

1. Chapman, R. F 2013 Insects: Structure and Function. Ed by Simpson, S. J. and Douglas, A. C. Cambridge Univ. Press, UK.
2. Richards, O.W. and Davies, R.G 1977. Imm's General Text Book of Entomology ( Vol. I and II). Chapman and Hall, London.
3. Wigglesworth, V.B 2013. Insect Physiology. Springer (Originally published by Chapman and Hall, London, 1974).
4. Pant, N.C. and Ghai, S. 198. Insect Physiology and Anatomy. ICAR, New Delhi.
5. Kapoor, V. C 2008. Theory and Practice of Animal Taxonomy. Oxford and IBH Publishing, New Delhi.
6. Charles A Triplehom and Norman F. 2005. Borror and De Long's Introduction to the Study of Insects. Johnson Thomson Brooks/Cole Publishing. U.S.A.
7. Snodgrass, R.E. 2001. Principles of Insect Morphology. CBS Publishers & Distributors, Delhi.
8. Timbhare, D.B. 2015. Modern Entomology, Himalaya Publishing House.

Course Code A12151      **SOIL AND WATER CONSERVATION ENGINEERING**      Credits: 2(1+1)

### Course outlines

#### UNIT- 1

Introduction to soil and water conservation and causes of soil erosion. Definition and agents of soil erosion, water erosion - Forms of water erosion - Gullyclassification and control measures. Soil loss estimation by universal soil loss equation - Soil loss measurement techniques. Principles of erosion control - Introduction to contouring, strip cropping.

#### UNIT- 2

Contour bund - Graded bund and bench terracing. Grassed water ways and their design. Wind erosion Mechanics of wind erosion, types of soil movement - Principles of wind erosion



control and its control measures.

### **UNIT- 3**

Introduction to irrigation - Classification of irrigation projects. Importance of irrigation water measurements - Volumetric, area velocity, discharge methods - Weirs, orifice, flumes. Open channel hydraulics - Discharge calculations.

### **UNIT- 4**

Types of wells - Water lifting devices - Classification of pumps, their capacity, power requirement and discharge calculations. Functional components and working principle of underground pipeline systems.

### **UNIT-5**

Functional components of micro irrigation systems and its design like drip, sprinkler irrigation systems etc. Water harvesting techniques - Lining of ponds, tanks and canal systems.

### **Practical**

1. Practicing survey - Principles and educating to use pacing technique for measurement.
- 2&3. Area calculations through chain survey - GPS demo for tracking and area measurement.
4. Estimation of soil loss and calculation of erosion index.
5. Leveling concepts and practical utility in agriculture.
6. Preparation of contour maps.
7. Concept of vegetative water ways and design of grassed water ways.
8. Construction of contour and graded bunds.
9. Wind erosion and estimation process.
- 10&11. Water discharge measurements lab exercises for computing discharge.
- 12&13. Different irrigation pumps and their constructional differences.
14. Farm pond construction and its design aspects.
15. Farm pond and canal lining and its procedures.
16. Visit to nearby farm pond.

### **References**

1. Ghanshyam Das., 2012. Hydrology and Soil Conservation Engineering, including Watershed Management. Second edition, PHI Learning Private Limited, New Delhi - 110001
2. Murthy, V. V.N., 2004. Land and Water Management Engineering. Kalayani Publishers, New Delhi
3. Michael A.M., 2007. Irrigation Theory and Practice. Second edition. Vikas Publishing House Pvt. Ltd.
4. Mal, B. C. 1995. Introduction to Soil and Water Conservation Engineering. Kalayani Publishers, Rajinder Nagar, Ludhiana
5. Kanetakar, T. P. 1993. Surveying and Leveling. Pune Vidyarthi Griha, Prakashan, Pune
6. Suresh, R. 2008. Land and Water Management. Standard Publishers Distributors, Delhi.

**UNIT- 1**

Introduction to Crop Physiology and its importance in Agriculture. Plant cell- The endomembrane system-Plasma membrane, endoplasmic reticulum, nuclear envelope, golgi apparatus, vacuole and endosomes- Structure and functional characteristics- Plastids, mitochondria, oil bodies, peroxisomes and glyoxysomes - Structure and functions. Metabolic changes during seed development- Seed viability and seed vigor- Tests of viability and vigor- Physiological maturity, harvestable maturity- Indices of physiological maturity in crops- Seed germination- Metabolic changes during seed germination. Growth and Development - Definition - Growth analysis – Growth Parameters- Definitions and mathematical formulae.

**UNIT- 2**

Absorption of water- Diffusion and osmosis- water potential and its components- Importance of water potential- Active and passive uptake of water- Stomatal complex- Transpiration- Water use efficiency- Water use efficiency of C3, C4 and CAM plants- Water requirement /Transpiration ratio – Factors affecting WUE. Mineral nutrition of plants- Essential mineral elements- Criteria of essentiality of mineral elements- Mengel's classification of mineral nutrients- Nutrient up take mechanisms-Functional roles of N, P, K, S Ca and Mg-Functional roles of Fe, Mn, Cu, Zn, B, Mo, Cl, Na, Co and Si- Deficiency symptoms of macro and micro nutrients. Assimilation of mineral nutrients- Nitrate assimilation- Ammonium assimilation in plants- Biological nitrogen fixation- Free living and symbiotic bacteria –Nodule formation- Nitrogenase enzyme complex.

**UNIT- 3**

Photosynthesis- Reactions of photosynthesis- Energy synthesis- Principle of light absorption by plants- Light reactions-Cyclic and non cyclic photophosphorylation- CO<sub>2</sub> fixation- C3 and C4 pathways-Significance of C4 pathway- CAM pathway and its significance- Photorespiration and its significance- Photosynthetic efficiency of C3, C4 and CAM plants- Factors affecting photosynthesis (light, CO<sub>2</sub>, temp and water stress)- Relationship of photosynthesis and crop productivity. Respiration-Energy balance- Significance of respiration- Oxidative Pentose Phosphate Pathway (OPPP) and its significance-Growth respiration and maintenance respiration- Alternate respiration- Salt respiration- Wound respiration.

**UNIT- 4**

Lipid metabolism – Bio synthesis of fatty acids in plastids – Functions of lipids - Significance of lipids in plant metabolism. Physiology of flowering – Photoperiodism and flowering- Importance of photoperiodism- Classification of plants based on photoperiodic responses - Perception of photoperiodic stimulus- Biological clock- Phytochrome- Flowering hormones- Vernalization and flowering- importance of vernalization in agriculture. Plant growth regulators- Auxins- Occurrence, transport, biosynthesis, mode of action and physiological roles- Commercial uses.- Gibberellins- occurrence, transport, biosynthesis, mode of action and physiological roles- Commercial uses- Cytokinins- Occurrence, transport, biosynthesis, mode of action and physiological roles- commercial uses- ABA- Occurrence, transport, biosynthesis, mode of action and physiological roles- Commercial uses- Ethylene- Occurrence, transport, biosynthesis, mode of action and physiological roles - Commercial uses.

## UNIT- 5

Senescence and abscission – Definition – Classification of senescence – Physiological and biochemical changes that occur during senescence- Prevention of leaf and flower senescence–Abscission and its relationship with senescence. Postharvest physiology– Dormancy– Types of dormancy– Advantages and disadvantages of dormancy- Causes of dormancy–Remedial measures for breaking seed dormancy- Fruit ripening- Climacteric and non climacteric fruits– Metabolic changes during fruit ripening- Hormonal regulation of fruit ripening– Ripening induction and ripening inhibition–Use of hormones in increasing vase life of flowers.

### Practical:

Lec. No.	Lecture Title
1	Preparation of solutions
2	Imbibition of seed
3	Seed vigour and viability tests
4	Optimum conditions for seed germination
5	Measurement of leaf area by various methods
6	Growth analysis – calculation of growth parameters
7	Measurement of water status in roots, stems and leaves
8	Measurement of water potential by Chardakov's method
9	Absorption spectrum of chloroplast pigments
10	Leaf anatomy of C3 and C4 plants
11	Stomata frequency and Index
12	Effect of ABA on regulation of stomata
13	Effect of plant growth regulators on plant growth
14	Plasmolysis of cell
15	Identification of nutrient deficiency symptoms in field crops
16	Yield Analysis

### References

1. Taiz,L.andZeiger,E.2010.*PlantPhysiology*5<sup>th</sup>edition, Sinauer Associates, Sunderland, MA,USA.
2. Gardner,F.P.,Pearce,R.B.,andMitchell,R.L.1985.*PhysiologyofCropPlants*.Scientific Publishers,Jodhpur.
3. Noggle,G.R.andFritz,G.J.,1983.*IntroductoryPlantPhysiology*.2<sup>nd</sup>Edition.PrenticeHall Publishers, New Jersey,USA.

## FUNDAMENTALS OF PLANT PATHOLOGY-I (PLANT PATHOGENS– AN INTRODUCTION)

### UNIT- 1

Introduction to Plant Pathology- Definition of Plant Pathology, Plant Pathogen, Plant Disease, Symptom, Disorder. Importance of plant diseases- Brief mention of Important epidemics of international importance – Irish Famine (1845), Bengal Famine(1942), Coffee rust (1868), Wheat Rust (1940), Southern Corn Leaf blight in USA. Epidemics of local significance- Peanut Stem Necrosis Disease (Anantapur dt), Mung bean yellow mosaic virus (AP)*etc.* Brief mention of economic importance of microorganisms. Scope and objectives of Plant Pathology. Important plant pathogenic organisms with one or two examples of important plant diseases caused by them – fungi (riceblast ,wheat rust), Chromista (*Pythium* damping off, late blight of potato protozoa (coffee phloem necrosis, club root of crucifers) bacteria rice bacterial leaf blight (BLB), cotton blackarm), fastidious Vascular bacteria (sugarcane ratoon stunt, citrus greening), Phytoplasma (sugarcane grassy shoot, sesamum phyllody), *Spiroplasma* (cornstunt), viruses (TMV,MYMV), viroids (potato spindle tuber viroid, coconut cadangcadang). Important plant pathogenic organisms with one or two examples of important plant diseases caused by them (contd)- algae (redrust), phanerogamic plant parasites (*Cuscuta*, *Striga*, *Orabanche*, *Loranthus*), nematodes (root knot and cyst nematode). Diseases and symptoms due to abiotic causes (khaira, cotton purple leaf, tomato blossom end rot, black heart of potato). General characteristics of fungi, fungus definition. Somatic structures- types of fungalthalli- plasmodium, unicellular and filamentous. Types of fungi based on reproductive structures- eucarpic, holocarpic. Types of fungi based on their physical presence on or In the host- ectophytic and endophytic (intercellular, intra cellular and vascular). Septation in fungi–Primary, adventitious, perforated and dolipore septa. Fungal tissues - plectenchyma (prosenchyma and pseudo parenchyma). Modifications of mycelium (rhizomorphs, sclerotium, stroma, haustorium, rhizoids and appressorium). Ultra structure of fungal cell. Fungal nutrition- groups of fungi based on mode of nutrition- saprophytes (obligate saprophytes and facultative parasite), parasites (obligate parasites and facultative saprophytes) and symbionts (mycorrhizae and lichens). Reproduction in fungi- asexual reproduction (mitospores)-fragmentation (arthrospores, oidia, chlamydo spores), fission, budding (blastospores), and sporulation – Sporangium, sporangiole, merosporangium. Spores-Plano and Aplano spores. Planospores – flagellum structure, types of flagella- tinsel, whiplash, Monoflagellate, Biflagellate, Anisokont and Heterokont zoospores. Conidiophore and Conidiospores (conidia). Asexual fruiting bodies with examples.

### UNIT- 2

Sexual reproduction– Phases in sexual reproduction, (meiospores). Methods of plasmogamy- planogametic copulation, gametangial contact, gametangial copulation, spermatization and somatogamy. Various life cycle patterns displayed by fungi–haplobiontic haploid, haplobiontic haploid (modified), haplobiontic diploid and diplobiontic life cycles with examples. Para sexual cycle. Sexual spores in fungi. Taxonomy - Nomenclature, Binomial system of nomenclature, rules of nomenclature, Classification of fungi as per Kirk *et al*(2008)- Keyto phylum, sub- phyla, classes, orders and families. Major characteristic features of Kingdom Fungi, Chromista and Protozoa. Characteristics of Phyla Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota and Mitosporic fungi (Anamorphic fungi) in Kingdom Fungi. Kingdom Fungi– Phylum Chytridiomycota, Class Chytridiomycetes- important characteristics of Order Chytridiales– Family

Synchytriaceae– disease caused by *Synchytriumendobioticum* (potatowart). Phylum Zygomycota– Subphylum Mucoromycotina– Order Mucorales– Family Mucoraceae, Genus *Rhizopus*, Example of disease caused by *Rhizopusarrhizus* (Headrot of sunflower). Family Choanephoraceae, Genus *Choanephora*. Example of disease caused by *Choanephoracucurbitarum* (Choenophora blight of chillies). Phylum Ascomycota– important characteristics of the phylum. Different types of ascocarps. Stile structures in ascocarps. Ascospore development in *Pyronemaomphaloides*. Morphology of asci. Types of asci based on structure of ascus wall, asci arrangement -fascicle, hymenium.

### UNIT- 3

Phylum Ascomycota, subphylum Taphrinomycotina (=Archiascomycetes) – Class Taphrinomycetes– Order Taphrinales, (i) Family Taphrinaceae- diseases caused by *Taphrina deformans* (peach leafcurl) and *T.maculans* (turmeric blotch). (ii) Family Protomycetaceae– Disease caused by *Protomycesmacrospores* (stem gall of coriander). Phylum Ascomycota Subphylum Pezizomycotina– (i) Class Eurotiomycetes– Subclass Eurotiomycetidae Order Eurotiales– Genera *Eurotium*, *Emericella* (*Aspergillus flavus*– aflatoxins), *Talaromyces*(*Penicillium italicum*– citrusbluemold). (ii)Class Leotiomycetes Order Erysiphales Family Erysiphaceae- *Erysiphe*, *Leveillula*, *Phyllactinia*, *Uncinula*, *Sphaerotheca*, *Podosphaera* and *Microsphaera*(key for genera of Erysiphaceae based on position of fungus on /in the host, conidial stages, number of asci per cleistothecium and cleistothecial appendages)– Important diseases caused by each of the genera. Order Helotiales Family Sclerotiniaceae Genus *Sclerotinia* (*Sclerotinia sclerotiorum*– white mold of vegetables). Phylum Ascomycota, Subphylum Pezizomycotina– (iii) Class Sordariomycetes, Subclass Sordariomycetidae Order Diaporthales Family Cryphonectriaceae, Genus *Cryphonectria*(chestnut blight) .Subclass Hypocreomycetidae Order Hypocreales - Family- Clavicipitaceae, Genus– *Claviceps* (ergot of sorghum and bajra). Family–Hypocreaceae–Genus–*Hypocrea* (Anamorph– *Trichoderma*, bio control agent). (iv) Class Dothidiomycetes Subclass– Dothidiomycetidae Order– Capnodiales– Family– Mycosphaerellaceae– Genus– *Mycosphaerella*(*M. arachidicola*(Groundnut early leaf spot), *M.personata*(Groundnut late leaf spot), *M. pinodes*(Ascochyta blight of chickpea). Order – Myriangiales– Family – Elsinoaceae– Genus – *Elsinoe* (*E. ampelina*– Grape anthracnose). Subclass – Pleosporomycetidae– Order – Pleosporales Family– Venturiaceae– Genus – *Venturia* (*V. inaequalis*– Apple scab). Family– *Pleosporaceae*– Genus– *Cochliobolus* (*C. miyabeanus*– brown spot of rice). Phylum Basidiomycota– important characteristics– Primary, Secondary and Tertiary mycelium, dolipore septum, clamp connections. Development of basidium and basidiospores, parts of basidium, dispersal of basidiospores, structure of *Agaricus bisporus* basidiocarp. Phylum Basidiomycota- Subphylum 1. Pucciniomycotina -Class Pucciniomycetes Order Pucciniales- Family– Pucciniaceae- Genera *Puccinia* (*three rusts of wheat*, groundnut rust) *Uromyces* (rust of green gram and black gram). Family - Melampsoraceae -Genus *Melampsora* (*M. ricini*– castor rust). *Uncertaesedis*(no family), *Hemileia* (*H. vastatrix*– coffee rust), Class Microbotryomycetes (Pucciniomycetous smuts)- Order -Microbotryales -Family Microbotryaceae - Genus –*Sphacelotheca*(Sorghum grain smut, loose smut and head smut of sorghum). Macrocytic, microcytic, demi cyclic rusts; Autoecious and Heteroecious rusts with examples. Life cycle of *Puccinia graministritici*. Phylum Basidiomycota – Subphylum 2. Ustilagomycotina Class Ustilaginomycetes Order

Ustilaginales- *Ustilago* (loose smut of wheat, sugarcane whip smut) and *Tolyposporium* (bajra smut). Order Urocystidales-Family - Urocystidaceae-Genus *Urocystis*(Onion smut).Class Exobasidiomycetes Order Tilletiales-Family-Tilletiaceae-Genera *Tilletia* (wheatbunts), *Neovossia* (Karnal bunt of wheat). Order Exobasidiales–Family-Exobasidiaceae–Genus *Exobasidium* (Tea blister blight). Differences between rust and smut fungi. Differences between smuts and bunts Phylum Basidiomycota– Subphylum3.Agaricomycotina Class Agaricomycetes-*Incertaesedis* (nosubclass) Order Polyporales - Family Ganodermataceae - Genus *Ganoderma* (coconut root rot and wilt).

#### UNIT- 4

Anamorphic Fungi (Mitosporic fungi= Fungi Imperfecti) Characteristics. Saccardoanspore group system. (1) Hyphomycetous anamorphic fungi: Identification features of Genera *Alternaria* (sunflower and sesamum leaf blight), *Botrytis* (castor grey mold), *Helminthosporium* (maize turicum leaf blight), *Bipolaris* (riebrownsplot), *Cercospora* (groundnut early leaf spot), *Phaeoisariopsis* (groundnut late leaf spot), *Fusarium* (cotton wilt), *Pyricularia* (riceblast), *Verticillium* (cottonwilt), MyceliaSterilia– *Rhizoctonia* (rice sheath blight, dry root rot), *Sclerotium* (stem rot of groundnut). Acervular Imperfect Fungi– *Colletotrichum* (sugarcane red rot), *Pestalotiopsis* (coconut greyleafspot), *Pestalotia* (guava leafspot), *Gloeosporium* (grape anthracnose). Pycnidia Imperfect Fungi – *Ascochyta* (chickpea blight), *Phoma*(blackleg of crucifers), *Phomopsis* (brinjal fruitrot) ,*Phyllosticta*(ginger leafspot), *Macrophomina*(dry rootrot) *Diplodia* (rose dieback) , *Botryodiplodia* (citrus stem end rot) , *Septoria*(leaf spot of tomato). Kingdom Chromista: Characteristics of Phylum Oomycota. Important characteristics of Class Oomycetes, Subclass- Peronosporomycetidae. Order Pythiales- Family- Pythiaceae– Genus- *Pythium* (damping off of nursery crops). Order Albuginales- Family- Albuginaceae- Genus- *Albugo* (white rust). Order Peronosporales-Family -Peronosporaceae- Genus –*Phytophthora* (late blight of potato). Downy mildew fungi *Sclerospora* (green ear of bajra), *Peronospora* (blue mold of tobacco), *Peronosclerospora*(sorghum downy mildew), *Pseudoperonospora* (cucurbitdownymildew), *Plasmopara* (grapedownymildew) and *Bremia* (lettucedownymildew) Sporangiphore branching and sporangialcharacteristics of downy mildew genera. Characteristics of Class Plasmodiophoreain Kingdom Protozoa. Important characteristics of Order Plasmodiophorida, Family Plasmodiophoraceae- differences in the characteristics of *Plasmodiophora*(clubroot of cabbage)and *Spongospora*(potato powdery scab). Prokaryotes – Characteristics of phytopathogenic bacteria, Classification (2<sup>nd</sup> Edition of Bergey’s Manual of Systematic Bacteriology, 2004). Identification of plant pathogenic bacteria based on morphological features. Domain Bacteria–Phyla Proteobacteria, Firmicutes and Actinobacteria Phylum Proteobacteria– Class Alphaproteobacteria- Order- Rhizobiales-Family- Rhizobiaceae- Genus- *Agrobacterium* (crown gall of stone fruits). Also *Candidatus Liberobacter* (citrus greening). Class Betaproteobacteria -Order -Burkholdariales- Family – BurkholdariaceaeGenus *Ralstonia*(bacterial wilt of solanaceous crops). Gammaproteo bacteria- Order - Xanthomonadales- Family -Xanthomonadaceae- Genera –*Xanthomonas* (BLB, BLS, citrus canker), *Xylella* (Pierce’s disease of grapes). Order Pseudomonadales - Family -Pseudomonadaceae-Genus -*Pseudomonas* (wild fire of tobacco). Order Enterobacteriales-Family- Enterobacteriaceae- Genera-*Erwinia* (Applefireblight), *Pectobacterium* (Soft rot of vegetables).

## UNIT- 5

Phylum Firmicutes.- Class Bacilli- Order-Bacillus-Family-Bacillaceae-Genus- *Bacillus* (Class Mollicutes Order Entomoplasmatales -Family- Spiro plasmataceae -Genus *Spiroplasma* (Corn stunt). Order –Acholeplasmatales- Family – Acholeplasmataceae- Genus- *Candidatus* *Phytoplasma* (Sesamum phyllody, Brinjal little leaf). Phylum Actinobacteria -Class-Actinobacteria- Order- Actinomycetales -Family- Microbacteriaceae- Genus *Clavibacter* (Wheat yellow ear rot/ tundu, sugarcane ratoon stunt). Family Streptomycetaceae Genus *Streptomyces* (Potato scab). Viruses and viroids- important characteristics of plant viruses and viroids- multiplication-classification of viruses based on nucleic acid (single stranded (ss) RNA, double stranded (ds) RNA, ss DNA and dsDNA). Taxonomy based on ICTV (2005). Important plant viral diseases- Tobacco Mosaic Virus (TMV) and Rice Tungro Virus (RTV). Methods of transmission of plant viruses with examples of vector transmitted virus diseases. Examples of important viroid diseases- potato spindle tuber viroid and coconut cadangcadang. Study of phanerogamic plant parasites with suitable examples –*Cuscuta*, *Orabanche*, *Striga*, *Loranthus*. Nematodes- Economic importance in agriculture- General characters of plant parasitic nematodes –classification. Nematodes- symptoms and nature of damage caused by plant nematodes (*Heterodera*, *Meloidogyne*, *Anguina*, *Ditylenchus*, *Tylenchorhynchus*, *Aphelenchoides* etc.).

### Practical

1. Microscopy - study of the parts of microscope.
2. Study of vegetative structures of fungi and their modifications.
3. Study of reproductive (sexual and asexual) structures of fungi.
4. Study of Zygomycetous fungus– *Rhizopus*, *Choanephora*.
5. Study of downy mildew fungi – *Sclerospora*, *Peronosclerospora*, *Pseudoperonospora*, *Peronospora*, *Plasmopara* and *Bremia*. Study of *Pythium*, *Phytophthora* and *Albugo*.
6. Study of powdery mildew fungi– *Oidium*, *Oidiopsis*, *Ovulariopsis*.
7. Study of ascocarps of *Erysiphe*, *Phyllactinia*, *Uncinula*, *Podosphaera* and *Microsphaera*..
8. Study of rust fungi *Puccinia* (different stages), *Uromyces*, *Hemileia* and *Melampsora*.
9. Study of smut fungi– *Sphacelotheca*, *Ustilago* and *Tolyposporium*. Study of *Ganoderma* and *Agaricus*.
10. Study of acervulous imperfect fungi–*Colletotrichum* and *Pestalotiopsis*. Study of pycnidial imperfect fungi – *Septoria*.
11. Study of imperfect fungi – *Aspergillus*, *Penicillium* and *Pyricularia*, *Helminthosporium*, *Alternaria*.
12. Study of imperfect fungi–*Cercospora* and *Phaeoisariopsis*, *Fusarium*, *Rhizoctonia* And *Sclerotium*.
13. Isolation of phytopathogenic bacteria (locally available diseased plant material) and study of colony characteristics.

14. Demonstration of mechanical transmission of plant viruses.
15. Extraction of plant parasitic nematodes from soil.
16. Study of morphological features and identification of plant parasitic nematodes.

**References:** For Fungi:

1. Dube, H.C.2013. *An Introduction to Fungi.4<sup>th</sup>(Edition)*.Scientific Publishers, Jodhpur, India. (major textbook)
2. Webster, J. 1989. *Introduction to fungi*. Cambridge Univ. Press(for life cycles of Fungi)
3. Dasgupta, M.K.1987. *Principles of Plant Pathology*. Allied Publ. Pvt Ltd. p985. (for rust lifecycles)
4. Students are also advised to refer *Introductory Mycology* by Alexopoulos, Mims and Blackwell (4<sup>th</sup> Edition) for Fungi.
5. For Bacteria, Viruses, Viroids, Phanerogamic Plant Parasites, Nematodes
6. Agrios, G.N.2006. *Plant Pathology*. Elsevier Publishers, New Delhi.

Course Code A12182

**PRODUCTION TECHNOLOGY OF FRUITS  
AND PLANTATION CROPS**

Credits 2 (1+1)

**UNIT- 1**

Importance and scope of fruit crops-High density planting- Canopy management-Use of rootstocks in fruit crops. Production technologies of Mango - Botanical name - Family – Origin – Introduction- Varieties–Climate–Soil-Propagation-Planting-Manuring-Irrigation–Inter-Cultivation–Harvesting–Yield-Physiological disorders: (Fruit drop-Alternate bearing-Spongy tissue etc). Production technology of Banana-Botanical name-Family–Origin-Importance-Varieties–Climate–Soil-Propagation-Planting–Manuring-Irrigation–Inter Cultivationpractices–Harvesting–Yield and postharvest handling-Physiological disorders. Production technology of Citrus-Botanical name–Family-Origin-Introduction-Varieties–Climate–Soil-Propagation-Planting-Manuring-Irrigation–Inter-Cultivation– Harvesting–Yield–Physiological disorders- Fruit drop –Granulation etc.

**UNIT- 2**

Production technology of Grape-Botanical name-Family-Origin Introduction- Varieties-Climate-Soil-Propagation-Planting-Manuring-Irrigation–InterCultivation-Harvesting, Yield-Physiological disorders. Production technology of Guava and Litchi-Botanical name-Family-Origin- Introduction-Varieties–Climate–Soil-Propagation-Planting-Manuring-Irrigation–InterCultivation–Harvesting–Yield– Physiological disorders-pests and diseases of litchi. Production technology of Papaya-Botanical name-Family-Origin-Introduction-Varieties–Climate–Soil–Propagation–Planting–Manuring-Irrigation–Inter Cultivation–Harvesting–Yield-pests of papaya.

**UNIT- 3**

Production technology of Apple, Pear, Peach-Botanical name–Family–Origin– Importance–Varieties –Climate –Soil- Propagation- Planting- Manuring- Irrigation– Inter Cultivation–Harvesting–Yield and storage-Physiological disorders-pests of apple, pear and peach-diseases of pear and peach. Production technology of Minor fruits-Pineapple, Pomegranate-



Botanical name- Family-Origin-Importance-Varieties–Climate–Soil-Propagation-Planting- Manuring - Irrigation–Inter-cultivation–Harvesting–Yield –Physiological disorders-pests of pomegranate-pests and diseases of pineapple. Production technology of Jackfruit, Strawberry, Nut crops (Almond & Walnut)- Botanical name- Family- Origin- Importance- Varieties – Climate –Soil- Propagation- Planting-Manuring-Irrigation–Inter cultivation– Harvesting–Yield- Physiological disorders- pests and diseases.

#### **UNIT- 4**

Plantation crops-Scope and Importance-Coconut–Botanical name-Family- Origin- Importance-Varieties–Climate–Soil-Propagation-Planting-Manuring- Irrigation–Inter cultivation–Harvesting–Yield–Processing- Physiological disorders. Production technology of Arecanut-Botanical name-Family-Origin-Importance- Varieties–Climate–Soil- Propagation-Planting-Manuring-Irrigation–Inter cultivation– harvesting–Yield–Processing- diseases of Arecanut. Production technology of Cashew-Botanical name-Family-Origin- Importance- Varieties–Climate–Soil-Propagation-Planting-Manuring-Irrigation–Inter cultivation– Harvesting–Yield–Processing- diseases of Cashew.

#### **UNIT- 5**

Production technology of Tea-Botanical name-Family-Origin-Importance- Varieties– Climate–Soil-Propagation-Planting-Manuring-Irrigation–Inter cultivation– Harvesting– Yield-Processing –pests of Tea. Production technology of Coffee-Botanical name-Family- Origin-Importance- Varieties–Climate–Soil-Propagation-Planting-Manuring-Irrigation– Inter cultivation– Harvesting–Yield-Processing- pests of Coffee. Production technology of Rubber-Botanical name-Family-Origin-Importance- Varieties–Climate–Soil-Propagation- Planting-Manuring-Irrigation–Inter cultivation– Harvesting–Yield-Processing - Physiological disorders- pests and diseases of Rubber.

#### *Practical*

1. Seed propagation-Scarification and stratification of seeds.
2. Propagation methods for fruit crops.
3. Propagation methods for plantation crops.
4. Micro-propagation.
5. Description and identification of commercially important fruit crops in Telangana state (Dragon Fruit, Custard Apple, Fig and Sapota).
6. Preparation of plant bio regulators and their uses.
7. Identification and description of varieties of major fruit crops (Mango, Banana, Citrus, Guava Grape and Apple).
8. Training and pruning methods followed in fruit crops.
9. Different methods of manuring and fertilization in fruit and plantation crops.
10. Different inter cultural practices/operations followed in fruit and plantation crops.
11. Postharvest handling and storage of fruit crops.
12. Fruit maturity and ripening and shelf life extension in fruit crops.
13. .Physiological disorders of fruit crops–Mango, Citrus, Grape
14. Physiological disorders of fruit crops-Banana, apple and other minor fruit crops.

15. Physiological disorders of the plantation crops.
16. Visit to commercial plantations/ fruit orchards.

### References

1. Bose, T. K. and Mitra, S. K. 1990. Fruits–Tropical and Sub-tropical. Naya Prakashan, Calcutta.
2. Chattopadhyaya, P. K. Year. Text Book on Pomology (Fundamentals of Fruit Growing). Kalyani Publishers, Ludhiana.
3. Bijendra Singh. 2012. Horticulture at a Glance. Kalyani Publishers, Ludhiana
4. Parthasarathy, V. A., P. K. Chattopadhyaya and Bose, T. K. 2006. Plantation Crops. Vol II and II. Parthasankarbasu Naya Udyog, Kolkata.
5. Kumar, N., Abdul Khader, J. B. M., Rangaswamy, P. and Irulappan, I. 2004. Introduction to Spices, Plantation crops, Medicinal and Aromatic Crops. Oxford and IBH publishing Co, New Delhi.

Course Code A12010

**AGRICULTURAL MICROBIOLOGY**

Credits 2(1+1)

### UNIT- 1

Introduction- Definition- The hidden world of microbiology- How microbes evolved on earth- General classification of microbes-Microorganisms and principles of microbiology- Scope of microbiology. Brief History of microbiology - Spontaneous generation theory- Contributions of Antony Van Leeuwenhoek- Francesco Redi- Lazzaro Spallanzani-Franz Schulze-Schroder and Von Dusch-Louis Pasteur- John Tyndall. Role of microbes in fermentation-Contributions of Cagnaird Latour-Theodor Schwann, F. Kutzing- Louis Pasteur - Germ theory of disease - Contribution of Hippocrates-Louis Pasteur- Robert Koch - Pure Culture Methods- Joseph Lister- Robert Koch- Beijerinck Winogradsky-Francois Appert-Schroder and Von Dush- John Tyndall. Protection against infection-Contributions of Edward Jenner- F. Loeffler- Behirng- Kitasasto Louis Pasteur - Applied aspects of Microbiology- Agricultural microbiology- Industrial microbiology-Food Microbiology - Medical microbiology – Water Microbiology - Geochemical Microbiology- Pollution microbiology – Air microbiology – Exo Microbiology – Microbial biotechnology. Morphological types of Bacteria, Bacteria cell Structure- External and internal cell structures Differences between Prokaryotes and Eukaryotes.

### UNIT- 2

Microbial Nutrition- Autotrophy - Chemoautotrophy-Photoautotrophy. Heterotrophy – Metabolic pathways-Glycolysis-HMP-ED-TCA cycle. Growth of Microorganisms - Cell Division - Growth cycle of bacteria [ Lag phase, Log phase, Stationary and Death phase]- Generation time- Growth rate- Growth yield- Synchronous - Diauxic growth.

### UNIT- 3

Bacterial genetics- Genetic recombination- Transformation- Conjugation- Transduction Plasmids- Transposon. Role of microbes in fertility of soils and plant growth-Rhizosphere-

Rhizoplane- Phyllosphere Phylloplane-Microflora-Carbon cycle-Carbondioxide fixation. Nitrogen cycle - Mineralisation- Immobilisation- Nitrification- Denitrification- Nitrogen Fixation - Phosphorus cycle, phosphorus solubilisation – Oxidation – Reduction - Sulphur cycle- Oxidation and reduction.

#### **UNIT- 4**

Biological nitrogen fixation - Symbiotic- Associative- Asymbiotic- Nitrogen fixation In *Azolla* - *Blue green algae* - Actinorhizal symbiosis - *Frankia*, Phosphate solubilizing microorganisms - *Bacillus-Pseudomonas-Mycorrhiza* for Phosphorous uptake. PGPR Organisms- *Bacillus – Pseudomonas – Azotobacter –Azospirillum – Rhizobium*. Food spoilage, food preservation and food fermentation, Types of fermentations – Batch - Batch fed- Continuous - Solid State Fermentations, Fermentative production of Alcohol.

#### **UNIT- 5**

Biofertilizers (Bacterial-Cyanobacterial-Fungal) production - Silage Production. Biopesticides- Viruses (*Nucleo polyhedrosis virus* - *Granular viruses*) – Bacteria (*Bacillus thuringiensis*, *Bacillus papilliae*) - fungi (*Beauveria* - *Verticillium*) - Protozoa (*Malameba locustae* *Mattesia* Spp) - Mode of action. Biofuel Production- Biodegradation – Biogas production, Biomanures and Microbiology of Composting.

#### **Practical**

1. Introduction to microbiology laboratory and equipments.
2. Aseptic methods in microbiology practical.
3. Methods of sterilization.
4. Nutritional media and their preparation.
5. Microscope – Parts, Principles of microscopy, resolving power, numerical aperture and micrometry.
6. Methods of isolation and purification of microbial cultures.
7. Maintenance of microbial cultures.
8. Isolation of rhizobium from legume root nodule and *Azotobacter* from soil.
9. Isolation of Phosphate solubilizing bacteria / Phosphate solubilizing fungi (PSB/PSF).
10. Isolation of *Azospirillum* from roots.
11. Bacterial Staining procedures-Simple staining, Gram's staining and Endospore staining.
12. Microscopic examination of biofertilizer organisms.
13. Enumeration of microbial population in soil – Bacteria / PGPR
14. Enumeration of microbial population in soil – Fungi and Actinomycetes.
15. Isolation of VAM from soil by wet sieving and decantation technique.
16. Determination of VAM by staining the infected roots / Morphological examination of VAM by section cutting.

## References

1. Microbiology. Pelczar, J.r., M.J.E.C.S. Chan and Krieg, N.R. (5th Ed.) 2015. McGrawHill Publishers, New York.
2. Microbiology. Prescott, L.M., Harley,J.P. and Klein, D.A. (9th Ed.) 2014. McGraw Hill Publishers, New York.
3. Brock Biology of Microorganisms. Madigan, M., Martinko, J.M and Parker, J. (14Ed.) 2015. Prentice hall of India Pvt Ltd., New Delhi.
4. Soil Microbiology: Subba Rao, N.S.(4thEd.) 2014. Oxford and IBH Publishing Company Pvt. Ltd., New Delhi.
5. Microbiology A Laboratory Manual: James, C and Natile, S. (10th Ed.) 2014. Pearson India Education Services Pvt. Ltd., South Asia.
6. Experiments in Microbiology, Plant Pathology and Biotechnology. Aneja, K.R.2011. New Age International (P) Ltd., Publishers, New Delhi