Rules and Syllabus for the Batchelor of Science (Honours) in Agriculture*

Indian Council of Agricultural Research

New Delhi

School of Agricultural Sciences

JIS University, Agarpara, Kolkata

*The Fifth Deans' Committee, ICAR vide office order F. No. Edn. 5.1.2013-EQR dated: July, 2013 .

CHAPTER-I

Regulations

1. Background,Syllabus and Commencement

The Regulations shall be called as " revised Regulations for the B Sc(Hons) Agriculture Degree recognized by theIndian Council of Agricultural Research (ICAR), New Delhi" These shall come in to effect from the academic year 2014-2015.The Regulations framed are subject to modifications from time to time by Indian Council of Agricultural Research, New Delhi.

2. Minimum qualification for admission

Candidates must have passed 10+2 examination from respective state/central Government authorities recognized as equivalent to 10+2 examination by the Association of Indian Universities (AIU) with English as one of the subjects and Physics, Chemistry,Mathematics (PCM)and or Biology (PCB/PCMB) as optional subjects individually.

3. Duration of the undergraduate programme

The course of study for BSc(Hons) Agriculture shall extend over a period of eight semesters (four acdemic years). The curricula and syllabi for the programme shall be prescribed from time to time by ICAR, New Delhi

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in a year

Each semester shall consist of not less than 100 working days. The odd semesters shall be conducted from the month of July/August to November/December and the even semesters shall be conducted from December/January to May/June in a caleder year.

6. Attendanceand progress

Acandidateisrequiredtoputinatleast80%attendanceinindividualcoursesconsidering theory and practical separately. The candidate shall complete the prescribedcourse satisfactorilyto beeligibleto appear fortherespectiveexaminations.

7. Program/Coursecreditstructure

As per the philosophy of Credit Based Semester System, certain quantum of academicwork viz. theory classes, tutorial hours, practical classes, etc. are measured

in terms ofcredits.Onsatisfactorycompletionofthecourses,acandidateearnscredits.Thenumber of creditsassociated witha course isdependent upon the number of hours of instructionper week in that course. Similarly, the credit associated with any of the other academic,co/extra-curricular activitiesis dependent uponthe quantumofwork expected tobe putinforeachoftheseactivities perweek.

Creditassignment

TheoryandLaboratorycourses

Courses are broadly classified as Theory and Practical. Theory courses consist oflecture (L) and /or tutorial (T) hours, and Practical (P) courses consist of hoursspent in the laboratory. Credits (C) for a course is dependent on the number ofhours of instruction perweek in that course, andis obtained by using a multiplierof one (1) for lecture.

Minimum credit requirement

The minimumcreditpointsrequired for awardof aBSc(Hons) Degree is 184.ThesecreditsaredividedintoTheorycourses,Practical,and Project over the duration of eight semesters. The credits are distributedsemester-wise. Courses generally progress in sequences,building competenciesandtheirpositioning indicatescertainacademic maturityon the part of the learners. Learners are expected tofollow the semester-wisescheduleof coursesgiveninthe syllabus.

8. Academic work

Aregular record of attendance both in Theory and Practical shall be maintained by the teaching staff of respective courses

9. Course of study

The course of study for BSc(Hons) Agriculture shall include Semester wise Theory and Practical as given in Table I- VIII. The number of hours to be devoted to each theory, tutorial and practical course in any semester shall not be less than that shown in Table-I to VIII.

Table-1: Course of study for Semester I

SEMESTER I						
Sl No	**Course Code**		**L**	**T**	**P**	**Credit**
THEORY						
1	AG 101	Agriculture Heritage	1	-		1
2	AGR 102	Fundamentals of Agronomy I	1	-		1
3	ACSS 103	Fundamentals of Soil Science I	1	-		1
4	AEN 104	Fundamentals of Agricultural Entomology I	2	-		2
5	PPA105	Fundamentals of Plant Pathology I	1	-		1
6	ABC 106	Fundamentals of Plant Biochemistry	2	-		2
7	HORT(A)107	Fundamentals of Horticulture	1	-		1
8	SWAG 108	Introduction to Forestry	1	-		1
9	AEX 109	Rural Sociology and Education Psychology	2	-		2
10	ENG 110	Comprehension and Communication Skills in English	1	-		1
11	AST III	Elementary Mathematics*	1			1
PRACTICAL						
12	AGR 102	Agronomy Laboratory			2	1
13	ACSS 103	Soil Science Laboratory			2	1
14	AEN 104	Studying Taxonomy of Insects			2	1
15	PPA 105	Preliminary Investigation on Plant Diseases			2	1
16	ABC 106	Plant Biochemistry Laboratory			2	1
17	HORT(A)107	Horticulture Laboratory			2	1
18	SWAG 108	Field laboratory			2	1
19	ENG 110	English Communication and Comprehension			2	1
MANDATORY NON CGPA COURSES						
20		NSS/NCC/Physical Education and Yoga Practices**				1
		Total	**14**			**20+2*+1****

*Remedial Course **Non-gradial Course

Table-2: Course of study for Semester II

SEMESTER II						
Sl No	Course No	Course Name	L	T	P	Credits
THEORY						
1	AGR 151	Fundamentals of Agronomy II	1	-		1
2	AGR 152	Crop Production Technology	1	-		1
3	ACSS 153	Fundamentals of Soil Science II	1	-		1
4	AEN 154	Fundamentals of Agricultural Entomology II	1	-		1
5	PPA 155	Fundamentals of Plant Pathology II	2	-		2
6	GPB 156	Fundamentals of Genetics	2	-		2
7	PPH 157	Fundamentals of Crop Physiology	1	-		1
8	AEC 158	Fundamentals of Agricultural Economics	2	-		2
9	AEX 159	Fundamentals of Agricultural Extension	2	-		2
10	SWC 160	Soil and Water Conservation	1	-		1
11	ASC 161	Livestock and Poultry Management	2	-		2
PRACTICALS						
12	AGR 151	Agronomy Laboratory			2	1
13	AGR 152	Crop Production Technology			2	1
14	ACSS 153	Soil Science Laboratory			2	1
15	AEN 154	Entomology			2	1
17	GPB 156	Genetics			2	1
18	PPH 157	Crop Physiology			2	1
19	AEX 159	Agricultural Extension Education			2	1
20	SWC 160	Soil and Water Conservation			2	1
21	ASC	Livestock and Poultry Management			2	2
NON-GRADIAL COURSE						
22	ET 162	Educational Tour	0	-	2	1
		TOTAL	**16**		**18**	**25+1****

** Non-gradial, preferably during Summer Vacation

Table-3: Course of study for Semester III

SEMESTER III						
Sl No	Course Code	Course Name	L	T	P	Credits
THEORY						
1	AGR 201	Crop Production Technology II (Kharif Crops)	1	-		1
2	GPB 202	Fundamentals of Plant Breeding	2	-		2
3	ACGP 203	Agricultural Microbiology	1	-		1
4	AEN 204	Pests of Crops and Storage and their Management	2	-		2
5	PPA 205	Disease of Field and Horticultural Crops and their Management I	1	-		1
6	AEC 206	Agricultural Finance and Cooperation	2	--		2
7	AEX 207	Communication Skills and Personality Development	1	-		1
8	ACH 208	Crop Protection Chemicals and their Applications	1	-		1
9	HORT(A) 209	Production Technology for Vegetable and Spices	1	-		1
10	AEG(A)210	Farm Machinery and Power	1	-		1
PRACTICALS						
11	AGR 201	Agronomy Laboratory			2	1
12	GPB 202	Plant Breeding Laboratory			2	1
13	ACGP 203	Agricultural Microbiology Laboratory			2	1
14	AEN 204	Entomology Laboratory			2	1
15	PPA 205	Plant Pathology Laboratory			2	1
16	AEC 206	Agricultural Economics			2	1
17	AEX 207	Class on Communication Skills			2	1
18	ACH 208	Studying Crop Protection Chemicals			2	1
19	HORT(A) 209	Studies on Production of Vegetable and Spices			2	1
	AEG (A) 210	Different aspects of Farm and Power			2	1
NON CGPA COURSES						
20	HVE	Human Values and Ethics	1			
		TOTAL				**23+1****

**** Non-Gradial Course**

Table-4: Course of study for Semester IV

SEMESTER IV						
Sl No	Course Code	Course Name	L	T	P	Credits
THEORY						
1	AGR 251	Crop Production Technology III (Rabi Crops)	1	-	-	1
2	AMP 252	Agro-meteorology and Climate Change	1	-	-	1
3	SST 253	Principles of Seed Technology	2	-	-	2
4	GPB 254	Crop Improvement I	1	-	--	1
5	ACSS 255	Manures, Fertilizers and Soil fertility Management	2	-	-	2
6	PPA 256	Disease of Field and Horticultural Crops and their Management	1	-	-	1
7	AEC 257	Agricultural Marketing, Trade and Price	2	-	-	2
8	AST 258	Elementary Statics	2	-	-	2
9	HORT (A)259	Production Technology of Fruits and Plantation Crops	1	-	-	1
10	EC 260-266	Elective Courses	2		-	2
PRACTICALS						
11	AGR 251	Agronomy Laboratory and Field			2	1
12	AMP 252	Meteorological Observatory and Laboratory			2	1
13	SST 253	Seed Technology Laboratory			2	1
14	GPB 254	Genetics and Plant Breeding Laboratory			2	1
15	ACSS 255	Soil Science Laboratory			2	1
16	PPA 256	Plant pathology Laboratory			2	1
17	AEC 257	Economics Laboratory			2	1
18	AST 258	Statistics Laboratory			2	1
19	HORT (A) 259	Horticulture Laboratory			2	1
20	**EC 260-266**	**Elective Courses as offered**			**2**	**1**
		TOTAL				**22+3***

***Elective Course**

Table-5: Course of study for Semester V

SEMESTER V						
Sl No	Course Code	Title of the Course	L	T	P	Credits
THEORY						
1	AGR 301	Crop Production Technology IV (*Kharif Crops*)	1	-		1
2	AGR 302	Rainfed Agriculture and Watershed Management	1	-		1
3	GPB 303	Crop Improvement II (*Kharif Crops*)	1	-		1
4	ABT 304	Principles and Practices of Biotechnology	1	-		1
5	ACSS 305	Problematic Soils and their Management	1	-		1
6	AEPP 306	Principles of Integrated Pest and Disease Management	2	-		2
7	AEC 307	Farm Management, Production and Resource Economics	1	-		1
8	AEX 308	Entrepreneurship Development and Business Communication	1	-		1
9	HORT (A) 309	Production Technology of Ornamental Crops, MAPs and Landscaping	1	-		1
10	MPHR 310	Protected Cultivation and Secondary Agriculture	1	-		1
11	EC 311-318	As per Elective Courses Offered	2*	-		2
PRACTICAL						
12	AGR 301	Agronomy Laboratory		-	2	1
13	AGR 302	Field Experimentation		-	2	1
14	GPB 303	Genetics and Plant Breeding Laboratory		-	2	1
15	ABT 304	Biotechnology Laboratory		-	2	1
16	ACSS 305	Soil Science Laboratory		-	2	1
17	AEPP 306	Plant Pathology and Entomology Laboratory		-	2	1
18	AEC 307	Economics Laboratory		-	2	1
19	AEX 308	Rural Development Laboratory		-	2	1
20	HORT (A) 309	Horticulture Laboratory		-	2	1
21	MPHR 310	Greenhouse Experimentation		-	2	1
22	**EC 311-318**	**Elective Courses as Offered**		**-**	**2**	**1***
		TOTAL	13			21+3*

***Elective Course**

Table-6: Course of study for Semester VI

SEMESTER VI						
Sl No	Course Code	Course Name	L	T	P	Credits
THEORY						
1	AGR 351	Principles of Organic Farming	1			1
2	AGR 352	Farming System and Sustainable Agriculture	1			1
3	GPB 353	Intellectual Property Rights	1			1
4	AEN 354	Management of Beneficial Insects	1			1
5	AGMP 355	Geo-informatics and Nanotechnology for Precision Farming	1			1
6	AST 356	Computer Applications and Agriculture Informatics	1			1
7	HORT(A) 357	Post-harvest Management and Value-addition of Fruits and Vegetables	1			1
8	AEG(A)358	Renewable Energy and Green Technology	1			1
9	FSN 359	Principles of Food Science and Nutrition	2			2
10	ES 360	Environmental Studies and Disaster Management	1			1
11	EC 361-368	As per Elective Courses Offered	2			2
PRACTICAL						
1	AGR351	Agronomy Laboratory			2	1
2	AGR 352	Agronomy Laboratoty			2	1
3	AEN 354	Entomology Laboratory			2	1
4	AGMP 355	Remote Sensing and Precision Farming			2	1
5	AST 356	Statistics Laboratory			2	1
6	HORT(A) 357	Post-harvest Processing			2	1
7	AEG(A)358	Energy Conservation			2	1
8	ES 360	Environmental Studies			2	1
9	**EC 361-368**	**Elective Courses as Offered**			**2**	**1**
		TOTAL	**13**			**19+3***

- **Elective Course**

Elective Courses offered for the Degree of BSc (Hons) Agriculture 4th, 5th and 6th Semester

- There are four groups for Elective Courses with a view to facilitate the choice of Subject at Higher level of Study as well as to equip with job opportunities in future.
- The total number of students of the Session are to be divided by the number of groups (4) to allot the students in different groups, but the maximum number of students in each group should not exceed the one-fourth of total students in the Semester +5.
- A student can opt one elective group based on the merit list i.e. OGPA up to 2nd Semester.
- A student can take a total of three elective courses covering a total of (3x3) 9 credits within the selected group during 4th,5th and 6th semesters, of which only one elective course at each semester

Group 1: Natural Resource Management and Crop Production

Sl No	Course No	Title of Course	Credits	Semester	Offering Department
1	EC 260	Hill, Dryland and Coastal Agriculture	3(2+1)	4th	AGR
2	EC 261	Production and Use of Biofertilizers	3(2+1)	4th	ACSS
3	EC 311	Agromet Advisory Services and Crop Modelling	3(2+1)	5th	AMP
4	EC 312	Watershed and Wetland Management	3(2+1)	5th	SWC+AGR+ANS
5	EC 361	Agriculture Waste Management	3(2+1)	6th	ACSS
6	EC 362	Deficiency and Toxicity of Elements in Soil, Plant and Water	3(2+1)	6th	ACSS

Agronomy (AGR)/Agricultural Chemistry (ACSS)/Agricultural Meteorology and Physics (AMP)/ Soil and Water Conservation (SWC)/Animal Sciences (ANS).

Group 2: Crop Protection

Sl No	Course No	Title of Course	Credits	Semester	Offering Department
1	EC 262	Chemistry of Pesticides	3(2+1)	4th	ACH
2	EC 263	Chemical and Bio-fungicides in Plant Disease Management	3(2+1)	4th	PPA
3	EC 313	Weed Management	3(2+1)	5th	AGR
4	EC 314	Bio-control Agents and Bio-pesticides in Insect Pest Management	3(2+1)	5th	AEN
5	EC 363	Detection and Diagnosis of Plant Diseases	3(2+1)	6th	PPA
6	EC 364	Non-insect Pests of Crops and their Management	3(2+1)	6th	AEN

Agricultural Entomology (AEN)/Plant Pathology (PPA)/Agronomy (AGR)/ Agricultural Chemicals (ACH)

Group 3: Crop Improvement and Commercialization

Sl No	Course No	Title of Course	Credits	Semester	Offering Department
1	EC 264	Plant and Molecular Biochemistry	3(2+1)	4th	ABC
2	EC 315	Plant Development Biology	3(2+1)	5th	PPH
3	EC 316	Quality Control of Seeds	3(2+1)	5th	SST
4	EC 365	Commercial Plant Breeding	3(2+1)	6th	GPB
5	EC 366	Micro-propagation Technologies	3(2+1)	6th	ABT
Agricultural Biochemistry (ABC)/ Plant Physiology (PPH)/Seed Science and Technology (SST)/ Genetics and Plant Breeding (GPB)/Agricultural Biotechnology.					

Group 4: Social Science including Agro-business

Sl No	Course No	Title of Course	Credits	Semester	Offering Department
1	EC 265	Agricultural Journalism	3(2+1)	4th	AEX
2	EC 266	Agricultural Business Management	3(2+1)	4th	AEC
3	EC 317	Strategies and Approaches of Agricultural Extension	3(2+1)	5th	AEX
4	EC 318	Statistical Methods I	3(2+1)	5th	AST
5	EC 367	Agricultural Development Policy Analysis	3(2+1)	6th	AEC
6	EC 368	Statistical Methods II	3(2+1)	6th	AST
Agricultural Economics (AEC)/Agricultural Extension (AEX)/Agricultural Statistics					

Table-7: Course of study for Semester VII

SEMESTER VII

Rural Agricultural Work Experience and Agro-Industrial Attachment (RAWE&AIA)
20 (0+20)

RAWE&AIA is one of the integral parts of Under-graduate programme comprising major two phases.

(a) Village attachment training programme
(b) Agro-industrial attachment

Sl No	Course No	Title of Course	Credits
1	RAWE&AIA	Rural Agricultural Work Experience and Agro-Industrial Attachment	20(0+20)
		Total	**20(0+20)**

The week-wise activities along with credit hours for RAWE&AIA are as following

Sl No	Activities	No of Weeks	Credit Hours
1	General orientation and oncampus training by different faculties	1	14
2	Village attachment	8	
3	Unit attachment in University/College/KVK/Research Station attachment	5	
4	Plant Clinic	2	2
5	Agro-Industrial attachment	3	4
6	Project Report Preparation, Presentation and Evaluation	1	
	Total	**20**	**20**

1. The total number of students of the session including extended campus should be divided in groups based on boy and girl students. Each group will consist of 25±5 students.

2. There will be a coordinating cell at the Faculty, which will be responsible to coordinate the entire programme during 7th semester.

3. Each group will be attached to a nearby village for a period of eight (8) weeks, when the programme will be managed by the departments of the faculty / associated faculties of the University mainly for rural system analysis, farm improvement planning, etc.

The week-wise activities and tasks during the programme are:

- Orientation and survey of village (1 week)
- Agronomical interventions (1 week)
- Plant protection interventions (1 week)
- Soil improvement interventions including soil sampling and testing (1 week)
- Fruit and vegetable production interventions (1 week)
- Food processing and storage interventions (1 week)
- Animal production interventions (1 week)
- Extension and transfer of technology activities (1 week)

1. Each group will be attached to at least five (5) units (Krishi Vigyan Kendras / Research Stations / other Campus) under the University or others within the state for a period of five (5) weeks on rotation basis, wherein one week for one unit system.

2. Each group will be attached to at least three (3) Agro or Cottage Industries (seed companies, rice mills, pesticide-insecticide companies, cold storages, post-harvest processing and value-addition sectors, agri-finance institutions, etc.) to get an experience of the industrial environment and working for a period of three (3) weeks on rotation basis, wherein one week for one industry system.

The activities and tasks during the programme are:

- Acquaintance with industry and staff
- Study on structure, functioning, objective and mandates of the industry
- Study on various processing units and hand-on training under supervision of
- industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of student

1. Each group will be attached to a plant clinic of the University / KVK for a period of two (2) weeks.

2. Daily field observation note book and weekly diaries maintained by the students along with final report for each phase duly signed by the concerned teachers / scientists / technical persons should be submitted to the coordinating cell.

The evaluation of the student's performance will be continuous, phase-wise at each unit and terminal in nature. The total marks for RAWE & AIA may be distributed unit / attachment-wise as: village attachment (30%), unit attachment in KVK / RRS / other campus (25%), plant clinic attachment (10%), agro-industries attachment (15%) and final evaluation (20%). The final evaluation will be made through presentation of activities, group discussion and central viva-voce

Table-8: Course of study for Semester VIII

SEMESTER VIII

Experiential Learning Programme (ELP)

Sl No	Course No	Title of Course	Credits
1	ELP 451	Production of Bio-agents and Botanical Pesticides	10 (0+10)
2	ELP 452	Commercial Seed Production	10 (0+10)
3	ELP 453	Mushroom Cultivation	10 (0+10)
4	ELP 454	Soil, Plant and Water Testing	10 (0+10)
5	ELP 455	Commercial Beekeeping	10 (0+10)
6	ELP 456	Organic Production	10 (0+10)
7	ELP 457	Commercial Sericulture	10 (0+10)
8	ELP 458	Plant Tissue Culture	10 (0+10)
		Total	**20 (0+20)**

Experiential Learning Programme (ELP) 2×(0+10) = 20

Modules for Skill Development and Entrepreneurship: A student has to register 20 credits opting for two modules of 10 (0+10) credits each from the package of modules mentioned below**.**

Sl. No.	Modul3	Credit(s)
1	Module I	10(0+10)
2	Module II	10(0+10)
	Total	**20(0+20)**

Sl. No.	**Course No.**	**Title of Module**	**Credit(s)**	**Departments* involved**
1	ELP 451	Production of Bio-agents and Botanical pesticides	10(0+10)	PPA + AEN + ACH + AEC*
2	ELP 452	Commercial Seed Production	10(0+10)	SST + AGR + AEC
3	ELP 453	Mushroom Cultivation	10(0+10)	PPA + HORT + AEX
4	ELP 454	Soil, Plant and Water Testing	10(0+10)	ACSS + AEX
5	ELP 455	Commercial Beekeeping	10(0+10)	AEN + AEC
6	ELP 456	Organic Production	10(0+10)	AGR + ACH + HORT + AEC
7	ELP 457	Commercial Sericulture	10(0+10)	AEN + AEC
8	ELP 458	Plant Tissue Culture	10(0+10)	ABT + GPB + AEX

*Please see page nos. 4-5

In Experiential Learning Programme (ELP), student's performance will be evaluated on the below mentioned parameters and marks distribution patterns.

Sl. No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	**100**

Semester-wise Credit Loads

Sl No	Semester	Credits
1	1st Semester	0+2*+1**=23
2	2nd Semester	25+1**=26
3	3rd Semester	23+1**=24
4	4th Semester	22+3=25
5	5th Semester	21+3=24
6	6th semester	19+3=22
7	7th Semester	20
8	8th Semester	20
	Total	**184**

Core Courses :135 Credits, Elective Courses :9 Credits, RAWE&AIA :20 Credits, ELP 20 Credits

10. ProgramCommittee

1. TheBSc(Hons) Agriculture programshallhaveaProgramCommitteeconstitutedby theHeadoftheinstitutioninconsultationwithall theHeadsofthedepartments.
2. ThecompositionoftheProgramCommitteeshallbeasfollows:
   A senior teacher shall be the Chairperson; One teacher from the Department; and four student representatives of the program (onefromeachacademicyear), nominated bytheHeadoftheinstitution.

3. DutiesoftheProgramCommittee:
   i. Periodicallyreviewingtheprogressof theclasses.
   ii. Discussing the problems concerning curriculum, syllabus and the conduct ofclasses.
   iii. Discussing with the course teachers on the nature and scope of assessment forthe course and the same shall be announced to the students at the beginning ofrespectivesemesters.
   iv. CommunicatingitsrecommendationtotheHeadoftheinstitutiononacademicmatters.
   v. The Program Committee shall meet at least thrice in a semester preferably attheendofeachSessional exam(InternalAssessment)andbeforetheendsemesterexamination.

11. Examinations/Assessments

ICAR prescribed system will be used for examination and assessment

11.1 Endsemesterexaminations

The End Semester Examinations for each theory and practical course through semestersIto VIII shall be conducted by the university.

11.2 Internalassessment:Continuousmode

ThemarksallocatedforContinuousmodeofInternalAssessmentshallbeawardedas pertheschemegivenbelo

Internalassessment:Continuousmode

ThemarksallocatedforContinuousmodeofInternalAssessmentshallbeawardedas pertheschemegivenbelow.

Schemeforawardinginternalassessment:Continuousmode

Theory		
Criteria	**MaximumMarks**	
Attendance	4	2
Academicactivities(Averageofany 3activitiese.g.quiz,assignment,openbooktest,fieldwork,group discussion and seminar)	3	1.5
Student–Teacherinteraction	3	1.5
Total	**10**	**5**
Practical		
Attendance	2	
BasedonPracticalRecords,Regularviva voce, etc.	3	
Total	**5**	

Guidelinesfortheallotmentofmarksforattendance

Percentageof Attendance	**Theory**	**Practical**
95– 100	4	2
90– 94	3	1.5
85– 89	2	1
80– 84	1	0.5
Lessthan80	0	0

Questionpaperpattern forendsemester theoryexaminations

For75markspaper

I.MultipleChoiceQuestions(MCQs) = 20 x1 = 20
OR OR
ObjectiveTypeQuestions(10x 2) = 10x2 =20
(Answerallthequestions)
II.LongAnswers (Answer2outof3) = 2x10=20
III.ShortAnswers(Answer7outof9) = 7x5 =35

Total = 75marks

11.2.1. SessionalExams

Two Sessional exams shall be conducted for each theory / practical course as per theschedule fixed by the college(s).The scheme of question paper for theory and practicalSessional examinations is given below. The average marks oftwo Sessional exams shallbecomputedforinternalassessment.

Sessional exam shall be conducted for 30 marks for theory and shall be computedfor 15 marks. Similarly Sessional exam for practical shall be conducted for 40 marks andshallbe computedfor10marks.

12. Promotion andawardofgrades

AstudentshallbedeclaredPASS andeligibleforgettinggrade inacourseofBSc(Hons) Agriculture program if he/she secures at least 50% marks in that particular course includinginternal assessment. For example, to be declared as PASS and to get grade, the student hasto secure a minimum of 50 marks for the total of 100 including continuous mode ofassessment andend semester theory examination and has to secure a minimum of 25marksforthetotal50includinginternalassessmentandendsemesterpracticalexamination.

13. Carryforwardofmarks

In case a student fails to secure the minimum 50% in any Theory or Practical course asspecified in 12, then he/she shall reappear for the end semester examination of that course.However, his/her marks of the Internal Assessment shall be carried over and he/she shall beentitled for gradeobtained byhim/her onpassing.

14. Improvementofinternalassessment

Astudent shallhavetheopportunity toimprove his/herperformanceonlyonce intheSessional exam component of the internal assessment. The re-conduct of the Sessionalexamshallbecompletedbeforethecommencementofnextendsemestertheoryexaminations.

15. Re-examination ofendsemesterexaminations

Reexaminationof endsemesterexamination shallbeconductedaspertheCouncil

regulations.Theexactdates ofexaminationsshallbenotifiedfromtimetotime.

Tentativescheduleofendsemesterexaminations

Semester	ForRegularCandidates	For FailedCandidates
I,III,VandVII	November/December	May/June
II,IV,VIand VIII	May/June	November/December

For50markspaper

I. LongAnswers(Answer2 outof3) = 2x10=20

II. ShortAnswers(Answer6out of8) = 6x5 =30

Total= 50marks

For35markspaper

I.LongAnswers (Answer1outof2)

= 1x10 =10

II.ShortAnswers(Answer5outof7) = 5x5 =25

Total= 35marks

Questionpaperpatternforendsemesterpracticalexaminations

I.Synopsis = 5

II.Experiments = 25

III.Vivavoce = 5

Total = 35marks

16. Gradingof performances

Examination and Evaluation System as per Fifth Deans Committee, ICAR

- Fifth Deans Committee Recommended Examinations and Evaluation Systems
- The Committee recommends Uniform Grading System to be followed with uniform OGPA requirements for award of Degrees at all levels and uniform conversion formulae to be followed for declaration of I, II, III division, distinction etc
- Declaration of Division in the Degree Certificate to be made compulsory by all universities

1. Examination (100%)

- Internal Theory as ell as Internal Practical (50%)
- External Theory

Sl No	**Nature of Exam/Categories of Courses**	**Nature of Exam/Categories of Courses**		**Courses with only theory**		**Courses with only practical**	
		Marks	**Duration**	**Marks**	**Duration**	**Marks**	**Duration**
1	Mid Term Exam	**20**	**One hour**	**50**	**One hour**	**--**	**--**
2	Internal Practical	**30**	**Two hours**	**--**	**--**	**100**	**Three hours**
3	Semester and Theory Exam	**50**	**Two hours**	**50**	**Two hours**	**--**	**--**
	Total	**100**	**--**	**100**	**--**	**100**	**--**

2. Evaluation

Degree	**Percentage of Marks Obtained**	**Conversion in to Points**
All	100	10 Points
	90 to <100	9 to<10
	80 to<90	8 to<9
	70 to<80	7 to<8
	60to <70	6 to<7
	50 to <60	5 to<6
	<50 (fail)	<5
	Eg 80.76	8.076
	43.60	4.360
	72.50 (but shortage in attendance)	Fail (1 Point)

Allotment of Division

OGPA	**Division**
5.000-5.999	Pass
6.000-6.999	II Division
7.000-7.999	I Division

8.000 and above	I Division with distinction

GPA= Total Point scored/Total credits
CGPA= Total Points Scored/ Course Credits
OGPA= Total Points Scored after excluding failure points

% of Marks=OGPAx100/10

Grading System in Under-graduate BSc(Hons) Agriculture

i) The marks obtained by a student out of 100 marks in each course in UG degree programme will be converted to grade points as given below in the table.

ii) The percentage of marks (or grade points) gained by a student over the pass marks (50% or 5.00 grade point) in repeated examination will be considered during calculation of GPA/CGPA/OGPA. The details of the calculation of Grade Point Average (GPA) is given in Annexure II.

Degree	Percentage of Marks obtained	Conversion in to Points
	100	10.00
BSc(Hons) Agriculture	90>100	9.00 to<10.00
	80>90	8.00<9.00
	70>80	7.00<8.00
	60>70	6.00<7.00
	50>60	5.00<6.00
	<50 Fail	<5.00 (F)

iii) The Grade Point obtained in a course will be multiplied by total credit(s) of that course and thereafter the Cumulative Grade Points obtained from all courses excluding the Non-gradial ones in a semester will be divided by total credits of that semester during calculation of GPA up to 6th semester. The details of calculation of Grade Point Average (OPA) is given in Annexure II.

The marks and/or grading system for READY I during 5th and 7th semester, RAWE&AIA/RHWE& AIA/READY II during 7th semester, and ELP/READY III during 8th semester will be followed as mentioned in Rule 4.02.

iv) The CGPA will be calculated from 2nd semester to 7th semester and the OGPA will be calculated at the end of 8th semester of UG degree programme

v) The final OGPA will be categorized in to classes as mentioned below:

OGPA	Class
5.00-5.99	Pass
6.00-6.99	II class
7.00-7.99	I class
8.00 and above	I class with distinction

(The Grading System may be printed in the Grade Card)

Annexure II

Calculation of Grade Point Average (GPA)

Example1: Students passing all the courses in 1st semester of BSc(Hons) Agriculture

Course No	Title of Course	Marks obtained in 100	Grade Point	Calculation of GPA	
				Credits	Grade Point X No of Credits
AG 101	Agriculture Heritage	79.03	7.90	1(1+0)	7.90x1=7.90
AGR 102	Fundamentals of Agronomy I	83.12	8.31	2(1+1)	8.31x2=16.62
ACSS 103	Fundamentals of Soil Science I	81.87	8.19	2(1+1)	8.19x2=16.38
AEN 104	Fundamentals of Agricultural Entomology I	82.31	8.24	3(2+1)	8.24x3=24.72
PPA 105	Fundamentals of Plant Pathology I	80.45	8.05	2(1+1)	8.05x2=16.10
ABC 106	Fundamentals of Plant Biochemistry	73.20	7.32	3(2+1)	7.32x3=21.96
HORT (A) 107	Fundamentals of Horticulture	81.65	8.17	2(1+1)	8.17x2=16.34
SWAG 108	Introduction to Forestry	84.64	8.46	2(1+1)	8.46x2=16.92
AEX 109	Rural Sociology and Education Psychology	82.00	8.20	2(2+0)	8.20x2=16.40
ENG 110	Comprehension and Communication Skills in English	78.32	7.83	2(1+1)	7.83x2=15.66
AST III	Elementary Mathematics	86.08	8.61	1(1+0)	8.61x1=8.61
NSS 112	NSS/NCC/ Physical Education and Yoga	83.83	8.38	1(0+1)*	177.61÷22=8.07
				GPA	8.07

- Non-Gradial Course
- Words and Figures in bold letters will be mentioned in Semester Grade Sheet

Student passing the courses with Repeat and Rearranged Examinations in First semester of BSc(Hons) Agriculture

Course No	Title of Course	Marks obtained in 100	Grade Point	Calculation of GPA		
				Grade Point for Repeat/ Rearrangement	Credits	Grade Point X No of Credits
AG 101	Agriculture Heritage	79.03	7.90		1(1+0)	7.90x1=7.90
AGR 102	Fundamentals of Agronomy I	83.12	8.31		2(1+1)	8.31x2=16.62
ACSS 103	Fundamentals of Soil Science I	81.87	8.19		2(1+1)	8.19x2=16.38
AEN 104	Fundamentals of Agricultural Entomology I	82.31	8.24		3(2+1)	8.24x3=24.72
PPA 105	Fundamentals of Plant Pathology I	80.45	8.05		2(1+1)	8.05x2=16.10
ABC 106	Fundamentals of Plant Biochemistry	73.20	7.32	7.32-5.00=2.32 (Repeat)	3(2+1)	2.32x3=6.96
HORT (A) 107	Fundamentals of Horticulture	81.65	8.17		2(1+1)	8.17x2=16.34
SWAG 108	Introduction to Forestry	84.64	8.46		2(1+1)	8.46x2=16.92
AEX 109	Rural Sociology and Education Psychology	82.00	8.20		2(2+0)	8.20x2=16.40
ENG 110	Comprehension and Communication Skills in English	78.32	7.83		2(1+1)	7.83x2=15.66
AST III	Elementary Mathematics	86.08	8.61		1(1+0)	8.61x1=8.61
NSS 112	NSS/NCC/ Physical Education and Yoga	83.83	8.38		1(0+1)*	162.61÷22=7.39
					GPA	**7.39**

- Non-Gradial Course
- Words and Figures in bold letters will be mentioned in Semester Grade Sheet

Lettergradesandgradepointsallocations:

Based onthe performances, each studentshall be awarded a final lettergrade at the endof the semester for each course. The letter grades and their corresponding grade points aregiveninTablebelow.

Letter grades and grade points equivalent toPercentageofmarksand performances

Percentageof MarksObtained	LetterGrade	GradePoint	Performance
90.00 –100	O	10	Outstanding
80.00–89.99	A	9	Excellent
70.00 –79.99	B	8	Good
60.00 –69.99	C	7	Fair
50.00 –59.99	D	6	Average
Lessthan50	F	0	Fail
Absent	AB	0	Fail

AlearnerwhoremainsabsentforanyendsemesterexaminationshallbeassignedalettergradeofAB andacorrespondinggradepointofzero.He/sheshouldreappearforthesaidevaluation/examinationi nduecourse.

17. TheSemestergradepointaverage(SGPA)

The performance of a student in a semester is indicated by a number called ‘SemesterGrade Point Average’ (SGPA). The SGPA is the weighted average of the grade pointsobtained in all the courses by the student during the semester. For example, if a studenttakesfive courses (Theory/Practical) ina semester withcreditsC1,C2, C3,C4and C5and the student’s grade points in these courses are G1, G2, G3, G4 and G5, respectively,andthenstudents’SGPAis

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for anysemester shall take into consideration the F and ABS grade awarded in that semester. Forexample if a learner has a F or ABSgrade in course 4, the SGPA shall then be computedas

18. CumulativeGradePointAverage(CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to twodecimal pointsand is indicated in final grade report card/final transcript showing the grades of all VIIIsemestersandtheircourses.TheCGPAshallreflectthefailedstatus incaseofFgrade(s), tillthe course(s) is/are passed. When the course(s)is/are passed by obtaining apass grade on subsequent examination(s) the CGPA shall only reflect thenewgrade andnotthefailgradesearnedearlier.

19. Declarationof class

Theclassshall be awarded onthe basisof CGPA as follows:

FirstClasswithDistinction =CGPAof.7.50 andabove

FirstClass =CGPAof6.00to7.49

SecondClass =CGPAof5.00to5.99

20. Projectwork

All the students shall undertake a project under the supervision of a teacher and submit areport. The area of the project shall directly relate any one of the elective subjects opted bythe student in semester VIII.The project shall be carried out in group not exceeding 5 innumber. The project report shall be submitted in triplicate (typed & bound copy not lessthan25pages).

The internaland external examiner appointed by the University shall evaluate the projectat the time of the Practical examinations of other semester(s). Students shall be evaluatedin groups for four hours (i.e., abouthalf an hour for agroupof fivestudents).Theprojectsshall beevaluatedasperthecriteria givenbelow.

EvaluationofDissertationBook:

Objective(s)of the workdone	15Marks
Methodologyadopted	20Marks
Results andDiscussions	20Marks
ConclusionsandOutcomes	20Marks

Total	75Marks

EvaluationofPresentation:

Presentationofwork	25Marks
Communication skills	20Marks
Questionandanswerskills	30Marks
Total	**75Marks**

Explanation: The 75 marks assigned to the dissertation book shall be same for all thestudents in a group. However, the 75 marks assigned for presentation shall be awardedbasedontheperformanceofindividual studentsinthegivencriteria.

21. Industrialtraining(Desirable)

See Table 7 and Table 8 (SEMESTER VIII and SEMESTER VIII)

22. PracticeSchool

As in SEMESTER VII amd SEMESTER VIII

23. AwardofRanks

RanksandMedalsshallbeawardedonthebasisoffinalCGPA.However,candidateswho fail in one or more courses during the BSc(Hons) Agriculture program shall not be eligible foraward of ranks. Moreover, the candidates should have completed the BSC(Hons) Agriculture program inminimumprescribednumberofyears,(fouryears)fortheawardofRanks.

24. Award ofdegree

Candidates who fulfill the requirements mentioned above shall be eligible for award ofdegreeduringtheensuingconvocation.

25. Durationforcompletion oftheprogramofstudy

Thedurationforthecompletionoftheprogramshallbefixedasdoubletheactualduration of the program and the students have to pass within the said period, otherwisetheyhavetoget fresh Registration.

26. Re-admissionafterbreakofstudy

Candidatewhoseeksre-admissiontotheprogramafterbreakofstudyhastogettheapproval fromtheuniversitybypayingacondonation fee.

Nocondonationisallowedforthecandidatewhohasmorethan2yearsofbreakupperiodand he/shehas torejointheprogram bypayingtherequiredfees

CHAPTER-II:SYLLABUS

SEMESTER-I

Course Code	**AG 101**			
Course Title	**AGRICULTURAL HERITAGE**			
Category				
LTP & Credits	L	T	P	Credits
	1	0	0	1
Total Contact Hours	10			
Pre-requisites	None			

Scope: This subject is designed to impart knowledge on heritage of Agriculture starting from the ancient era.

Objectives:Uponcompletionofthiscoursethestudentshouldbeableto

- Understand the journey of agriculture from pre-historic era to present time
- Understand the changes took place during a journey several thousands of years
- Understand the relevance of heritage to modern agriculture
- Understand the importance of agricultural resources available in India
- Learn the current scenario of Agriculture

CourseContent

UNIT– I

05Hours

- Introduction of Indian agricultural heritage
- Ancient agricultural practices
- Relevance of heritage to present day agriculture
- Past and present status of agriculture and farmers in society
- Journey of Indian agriculture and its development from past to modern era

UNIT-II **05 Hours**

- Plant production and protection through indigenous traditional knowledge
- Crop voyage in India and world;
- Importance of agriculture and agricultural resources available in India
- Crop significance and classifications
- Current scenario of Indian agriculture
- Indian agricultural concerns and future prospects.

Recommended Book (Recent Edition)

- Kumari D and Veera M:Text Book on Agriculture Heritage of India, Manimuthu Publishers
- Giri U and Hedayetullah Md: Text Book of Agriculture Heritage, Scientific Publishers.

Reference Books

- Zaman A: Agriculture Hertage, New India Publishing Agency, NIPA
- Adhikari M M: Text Book of Agricultural Heritage, DAYA Publishing House.
- Reddy S R: Agriculture Heritage, Kalyani Publishers.

CO PO MAPPING

Course Outcome (CO)	Program Outcome (PO)										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**
AGR 101.1	2	1	-	2	-	-	-	-	-	-	3
AGR 101.2		3	-	3	-	1	-	-	-	-	3
AGR 101.3	-	-		2	-	1	-	-	-	1	2
AGR 101.4	-	3	1	1	1	-	-	1	-	-	-
AGR 101.5	3	-	1	-	2	1	-	-	-	-	1

Course Code	AGR 102			
Course Title	FUNDAMENTALS OF AGRONOMY I			
Category				
LTP & Credits	L	T	P	Credits
	1	0	1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: This subject is designed to impart fundamental knowledge on cultivation practices. Crop nutrition, manures and fertilizers, nutrient use efficiency; Growth and development of crops, Plant ideotypes; Crop rotation and its principles; Adaptation and distribution of crops; Agro-climatic zones of India and West Bengal.

Weeds: importance, classification, crop-weed association / competition; Weed management: concept, principles, methods, merits, demerits and utilization; Cultural and mechanical weed management practices; Chemical weed management, herbicides: classification, selectivity, resistance, formulations and mixtures, concept of adjuvants, safeners and surfactants; Biological weed management, bio-herbicides and allelopathy

Objectives:Uponcompletionofthiscoursethestudentshouldbeableto

- Learn about the growth and development of crops and their ideotypes
- Understand the typical crop rotations under different Agro-climatic conditions of West Bengal and India
- Perform integrated weed management under different cropping systems
- Learn t different aspects of Bio-herbicides and their efficacy
- Learn the use of Surfactants in eradication of weeds

CourseContent:

Unit-I 5 hours

- **Introductiontocrop Production Technology**
- Crop density and geometry;

- Crop nutrition, manures and fertilizers,
- Nutrient use efficiency;
- Growth and development of crops,
- Factors affecting growth and development.

Unit-II 05 hours

- **Weed management**
- Weeds, importance, classification,
- Crop-weed association / competition;
- Weed management: concept, principles, methods, merits, demerits and utilization
- Cultural and mechanical weed management practices
- Chemical weedicides/herbicides to control the menace of obnoxious plant growth

Unit-III 05 hours

- **Use of Chemical herbicides**
- Chemical weed management,
- Herbicides: classification,
- Selectivity, resistance, formulations and mixtures,.
- Concepts of adjuvants, safeners and surfactants
- Biological weed management, without using chemical herbicides

UnitIV 05 hours

- **Study on yield contributing characters and yield estimation**
- Soil fertility,
- Plant nutrition,
- Seed quality and
- Nutrient management

UnitV 05 hours

Numerical exercises on fertilizer requirement and plant population

- Very important with respect to practice of precision farming

RecommendedBooks(LatestEditions)

- Reddy S R and Ramu Reddi Y:Agronomy of Field Crops, Kalyani Publishers, New Delhi
- Singh S S and Singh R: Crop Management under Irrigated & Rainfed Condition, , Kalyani Publishers,New Delhi
- Das N R:IntroductiontoCropsofIndia.2nd Edition, ICAR, New Delhi

Reference Books

- Joseph Antony:AgroforestryTheoryandPractices, ICAR, New Delhi
- Walia US:CropManagement, Scientific Publishers
- Jat M L:DrylandTechnology,2ndEd. ICAR, New Delhi
- JainL K:ManualonFundamentalsofAgronomy, ICAR, New Delhi
- DasNR:PracticalManualonBasicAgronomy(WithTheory)(2ndEdition), Kalyani Publications
- WaliaUS:ScienceofAgronomy, Scientific Publishers
- AryaRL:FundamentalsofAgronomy, Scientific Publishers

CO PO MAPPING

Course Outcome (CO)	Programme Outcome (PO)										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO 11**
AGR 102.1	2	3	-	2	-	-	-	-	-	-	3
AGR 102.2	2	3	-	2	-	1	-	-	-	-	3
AGR 102.3	3	-		3	-	1	-	-	-	1	2
AGR 102.4	-	3	1	1	1	-	-	1	-	-	-
AGR 102.5	3	-	1	-	2	1	-	-	-	-	1

Course Code	**ACSS 103**			
Course Title	**FUNDAMENTALS OF SOIL SCIENCE I**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope:Thiscoursedealswiththefundamentalsofrocks and minerals, weathering, soil formation,soil physical, chemical and biological properties.

Objectives: Uponcompletionofthecoursestudentshallbeableto

- Understandtheprinciplessoil weathering
- Know the processes of soil formation from rocks and minerals
- Study soil colloidal properties, clays, buffering properties, soil fertility and crop productivity
- Understand Clay Mineralogy
- Learn acid-base properties of soil

CourseContent

UNIT-I **05Hours**

- Soil as a natural body: Scope of studies
- Pedological and edaphological concepts of soil
- Soil genesis, soil forming rocks and minerals
- Soil physical and chemical properties
- Knowledge of taxonomy classification of India
- Inorganic and organic colloids

UNIT-II **05 Hours**

- Soil physical and chemical properties
- Structure, texture, porosity, Bulk density, Particle density
- Soil colour, consistency, Plasticity and water holding capacity
- Soil reaction, soil acidity and alkalinity
- Base saturation of soil, Lime requirement

UNIT-III **05 Hours**

- Soil taxonomy classification and soils of India
- Classification of world soils based on USDA categories
- Classification of Indian Soils
- Soil water movement, retention, movement and availability
- Soil air, composition, gaseous exchange, problem and plant growth

UNIT-IV **05Hours**

- Soil colloids and their properties
- Layer silicates, structure and properties
- 1:1 and 2:1 types of clay minerals
- Cation exchange capacity
- Organic colloids and humus

PRACTICAL

UNIT-V **05Hours**

- Soil sample processing and storage
- Analysis for carbon, nitrogen, phosphorus, and potassium
- Analysis of micronutrients
- Soil analysis for physical properties
- Bulk density and Particle density of soil

- Determination of soil aeration and related properties
- Determination of soil texture by feel and Bouyoucos Methods**.**
- Soil Capillary properties
- Determination of water movement in soils

Recommended Books:(LatestEditions)

- Das D K: Introductory Soil Science, 2nd Edition, Kalyani Publishers, New Delhi
- Rattan R K, Katyal J C, Dwivedi B ,Sarkar A K, Bhattacharya T, Tarafdar J C and Kukal S S: Soil Science-An Introduction, Indian Society of Soil Science, New Delhi
- Goswami N N, Rattan R K, Dev G, Narayanasamy G, Das D K, Sanyal S K, Pal D K and and Rao D L N: Fundamentals of Soil Science, , 2nd Edition, Indian Society of Soil Science, New Delhi.
- Arya R L: FundamentalsofSoilScience, Indian Council of Agricultural Research, New Delhi.
- JacksonML:SoilChemicalAnalysis:Prentice Hall of India Ltd, New Delhi
- GuptaSK:StandardMethodsforAnalysisofSoilPlantandWater
- Academic Press, USA.
- FAO:TheUseofSalineWatersforCropProduction. Rome, Italy
- PiperCS:SoilandPlantAnalysis.
- Ryan J:SoilandPlantAnalysis:LaboratoryManual

Reference Books

- BearFE:ChemistryofTheSoil,2ndEd. Willey Blackwell
- USDA:SoilSurveyManualNewRevisedEd.
- Fried,M:TheSoil-PlantSysteminRelationtoInorganicNutrition, Academic Press

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
ACSS 103.1	1	1	3	-	-	-	-	-	1	-	-	
ACSS 103.2	3	-	3	-	-	2	-	-	-	-	3	
ACSS 103.3	3	-	-	3	-	1	-	-	-	-	2	
ACSS 103.4	-	-	-	-	-	3	-	-	2	-	1	
ACSS 103.5	3	2	-	1	-	-	-	-	-	-	2	

Course Code	**AEN 104**			
Course Title	**FUNDAMENTALS OF AGRICULTURAL ENTOMOLOGY I**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	35			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeonthepreparatory aspects of Agricultural Entomology and its scope and importance

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Knowthehistoryof Entomology in India
- Understandthebasicsofdifferentmajor points related to dominance of Insecta in Animal Kingdom.
- Understand theclassification of Phylum Arthropoda up to classes
- Learn the relationship of class Insecta with other classes of Arthropoda.
- Understand the structure and functions of insect cuticle and moliting

CourseContent

UNIT– I **05Hours**

- **Historical background of the subject Entomology**: Historyof development, the works on both beneficial and harmful insects, dominance of Insecta, classification of major insects and their inter-relationship.
- **Classification:**Classification of Arthropoda up to classes
- **Relationship:**Relationship of class Insecta with different classes of Arthropods
- **Morphology:**Structures and functions of insect cuticles and moulting.

UNIT– II **05Hours**

- **Body segmentation**:Structure of head, thorax and abdomen
- **Structure and modification of different body parts**: Insect antennae, mouth parts, legs.
- **Wing venation**: Modifications of wing coupling apparatus
- **Structure of genital organs**: Male and female insects, sense organs.
- **Metamorphosis and diapause in insects**: Development through egg, larvae, pupa and adults.

UNIT-III **05 Hours**

- **Structure and functions of different organs**: Digestive, circulatory, excretory, respiratory, nervous, secretary(Endocrine) and reproductive system.
- **Taxonomy**: Importance, history and development and binomial nomenclature.
- **Definition of Biotype**: Sub-species, species, genus, family and order.
- **Classification**:Classification of class of insects up to order
- **Order**: Basic groups of present-day insects with special emphasis to Order and Families of agriculturally important Orders

UNIT-IV

05Hours

- **Order**: Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae;
- **Order :** Dictyoptera: Mantidae, Blattidae;
- **Order :** Odonata
- **Order :**Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae;
- **Order:** Neuroptera: Chrysopidae.

UNIT-V **05Hours**

- **Order**: Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae
- **Order:** Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae;
- **Order:** Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae
- **Order:** Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae,Muscidae, Tephritidae.
- **Collection:** Method of collection of insects and their preservation, dissection of different systems.

UNIT-VI **05Hours**

- Methods of collection and preservation of insects including immature stages
- External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs
- Wing venation, types of wings and wing coupling apparatus.
- Dissection of digestive system in insects (Grasshopper**)**
- Dissection of male and female reproductive systems in insects (Grasshopper)

UNIT-VII **05Hours**

- Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.
- Insecticides and their formulations
- Pesticide appliances and their maintenance
- Sampling techniques for estimation of insect population and damage.
- Types of insect larva and pupa

Recommended Books:(LatestEditions)

- Ragumoorthi K N,Balasubramani V, Srinivasan M R and Natarajan A E: Insecta – An Introduction.Kalyani Publishers
- Prasad T V: Handbook of Entomology New Vishal Publications
- Dhaliwal G S,Singh R and Jindal V:A Textbook of Integrated Pest Management, Kalyani Publishers
- Reddy D S:Applied Entomology New Vishal Publications

Reference Books

- Vasantaraj David B and Ramamurthy V V :Elements of Economic Entomology (8th Edition) Brillion Publishing
- Walia R K and Bajaj H K:Textbook of Introductory Plant Nematology, Indian Council of Agricultural Research, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
AEN104.1	3	1	3	-	-	-	-	-	1	-	-	2
AEN104.2	2	3	3	-	-	2	-	-	-	-	3	2
AEN 104.3	3	-	-	3	-	1	-	-	-	-	2	-
AEN104.4	-	-	-	-	-	3	-	-	2	-	1	-
AEN104.5	3	2	-	1	-	1-	-	-	-	-	2	1

Course Code	**PPA 105**			
Course Title	**FUNDAMENTALS OF PLANT PATHOLOGY I**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeonthepreparatory aspects of Plant Pathology.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Knowtheimportance of plant pathogen and pathology.
- Understandthedisease-causing organisms.
- Understand theclassification plant pathogens
- Understand the plant disease caused by bacteria, fungi and virus.
- Learn the preventive and curative measures against the diseases.

CourseContent

UNIT– I **05Hours**

- **Plant pathogenic organisms**: Different groups of microorganisms.
- **Classes:**Fungi, bacteria, fastidious vesicular bacteria.
- **Relationship:**Phytoplasmas, spiroplasmas, viruses. viroides.
- **Others:** Algae, protozoa.
- **Types:** Phanerogamic parasites and nematodes.

UNIT– II **05Hours**

- **Fungi**:General characters, definition of fungus.
- **Fungi**:Somatic structure,types of fungal thalli, fungal tissues.
- **Fungi**: Modifications of thallus.
- **Reproduction**:Sexual , asexual.

UNIT-III **05 Hours**

- **Nomenclature**:General.
- **Nomenclature**: Binomial system of nomenclature.
- **Nomenclature**:Rules of nomenclature
- **Classification**:Fungi, key to division and sub-division
- **Order**:Main orders and classes

UNIT-IV **05 Hours**

- **Bacteria and mollicutes**: Common characters
- **Bacteria and mollicutes:**General morphologicalcharacters.
- **Bacteria and mollecutes:**Basic methods of classification.
- **Bacteria and mollicutes:**Reproduction;

UNIT-V **05Hours**

- **Instrumentation**: Acquaintance with various laboratory equipment, microscopy
- **Preparation of Media:**Isolation and Koch's postulates.
- **General study:**Different structures of fungi, study of symptoms of various plant diseases.
- **Study:**Staining and identification of plant pathogenic bacteria
- **Virulence:** Transmission of plant viruses, study of fungicides and their safe use

Recommended Books:(LatestEditions)

- Mehrotra R S and Aggarwal A:Fundamentals of Plant Pathology Mc GrawHill Education Private Limited, New Delhi.
- Dube H C:AnIntroductiontoFungi,4thEd. ICAR, New Delhi
- Bajaj H C:HandbookofPracticalNematology,Scientific Publishers.
- Reddy P:TextBookofIntroductoryPlant Nematology. ICAR, New Delhi
- Gour HN:AnnualReviewofPlantPathology(1-6), ICAR, New Delhi.

Reference Books

- Singh R S: Introduction to Principles of Plant Pathology (5th Edition) Oxford & IBH Publishing Company PVT. LTD.
- Singh R S:Plant Diseases (10th Edition) Oxford & IBH Publishing Company PVT. LTD.
- Rangaswami G and Mahadevan A: Disease of Crop plants in India (4th Edition) Prentice Hall India Learning Pvt. Ltd, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PPA105.1	3	1	3	-	-	-	-	-	1	-	-	
PPA105.2		3	3	-	-	2	-	-	-	-	3	
PPA 105.3	3	-	-	3	-	1	-	2	-	-	2	
PPA105.4	2	-	-	-	-	3	-	2	2	-	1	
PPA 105.5	3	2	-	1	-	-	-	-	-	-	2	

Course Code	**ABC 106**			
Course Title	**FUNDAMENTALS OF PLANT BIOCHEMISTRY**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	35			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeontheimportance of Biochemistry and its importance.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Knowtheimportance of Plant biochemistry.
- Understandthechemistry of Carbohydrates.
- Understand thechemistry and classification of Lipids
- Understand the importance of Protein and classification
- Learn the chemistry of Enzymes and classification

CourseContent

UNIT– I **07Hours**

- **Importance of Biochemistry**: Its use in study of water, pH and Buffer.
- **Carbohydrate:**Its importance and classification.
- **Structure:**Monosaccharides and polysaccharides
- **Properties:**Reducing and oxidising properties of monosaccharides
- **Properties:** Mutarotation

UNIT-II **07 Hours**

- **Protein**: Classification
- **Protein**: Introduction and importance
- **Properties:** Lipids, importance and classification

- **Fatty acids**: Structure and properties of fatty acids
- **Protein:** Structures
- **Properties:**Titration and Zwitterions nature of aminoacids
- **Structural organization of proteins:**Properties

UNIT-III **07 Hours**

- **Enzymes**: General properties
- **Enzymes:** Classification
- **Enzymes:** Mechanisms of action.
- **Properties:**Mechanisms of action, Michaelis and Menten and line Weaver Burk Equation and plots

UNIT-IV **07 Hours**

- **Nucleic acids**: Introduction to Allosteric enzymes
- **Ncleotides:**Introduction, classification and structures, A, B and Z DNA
- **Structure:** Types and Secondary and Tertiary structure
- **Metabolism:** Carbohydrates, Glycolysis, TCA cycle, Glyoxylate cycle
- **Electron Transport Chain, metabolism of Lipids, Beta oxidation, Biosynthesis of fatty acids.**

UNIT-V **07 Hours**

- **Analysis**: Quantitative tests of carbohydrates and amino acids
- **Analysis:** Quantitative estimation of glucose/ proteins
- **Analysis:** Titration method for estimation of amino acids and lipids
- **Properties:** Effect of pH, temperature and substrate concentration on enzyme action
- **Analysis:** Paper chromatography/TLC demonstration for separation of amino acids/monosaccharides.

Recommended Books:(LatestEditions)

- SaxenaJ:LaboratoryManualofMicrobiology,BiochemistryandMolecularBiology, Academic Publishers
- SaxenaJ:ComprehensiveLaboratoryManualofLifeScience, Scientific Publishers
- PuniaMS:PlantBiotechnologyandMolecularBiology-ALaboratoryManual, ICAR, New Delhi
- BalaM:PracticalsinPlantPhysiologyandBiochemistry, ICAR, New Delhi

Reference Books

- Donald Voet & Judith G. Voet,Biochemistry John Wiley & Sons
- David L. Nelson & Michael M. Cox W.H, Principles of Biochemistry. Freeman & Co Ltd G.
- Nagaraj G,Agricultural Plant Biochemistry New India Publishing Agency .
- S.S. Purohit and A. Joshi, Textbook of Agricultural Biochemistry Agrobios (India)

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
ABC 106.1	3	2	3	-	-	-	-	1	1	-	-	1
ABC 106.2	3	2	3	-	-	2	-	2	-	-	3	-
ABC 106.3	3	-	-	3	-	1	-	-	-	-	2	2
ABC 106.4	-	-	-	-	-	3	-	-	2	-	1	-
ABC 106.5	3	2	-	1	-	-	-	-	-	-	2	-

Course Code	**HORT (A) 107**			
Course Title	**FUNDAMENTALS OF HORTICULTURE**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeontheimportance of Horticulture

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand Horticulture, its aims and objectives.
- Understandthe different streams of Horticulture
- Learn the importance in terms of economy
- Understand different techniques of mass propagation
- Learn the scope and importance of different branches of Horticulture

CourseContent

UNIT– I **05Hours**

- **Horticulture:** Its definition and branches
- **Horticulture:**Its importance and scope
- **Classification:**Botanical and horticultural classification
- **Cultivation:**Climate and soils for horticultural crops
- **Plant propagation:**Enhanced seeds and propagules

UNIT-II **05Hour**

- **Propagating materials:**Seed, seedlings, cuttings.
- **Propagation:** Plant tissue culture, somaclonal variations
- **Multiplication**: Seed dormancy, seed viability.
- **Seed quality**: Testing for confirmation
- **Germination**: Multiplication of planting materials

UNIT-III **05 Hours**

- **Principle of orchard establishment**
- **Principle and methods of training and pruning**
- **Juvenility and flower bud differentiation**
- **Unfruitfulness**
- **Tree, herbs, shrubs**

UNIT-IV **05 Hours**

- **Polination, polinizers, and polinators**
- **Fertilization and parthenocarpy**
- **Medicinal and aromatic plants, their scope farm scale cultivation**
- **Different groups of medicinal and aromatic plants**
- **Major alkaloid and essential oil-bearing plants**

UNIT-V **05 Hours**

- **Importance of plant-bioregulators**
- **Ferilizer applicationand irrigation management**
- **Techniques of measuring tree height**
- **Nursery preparation, seed sowing**
- **Vegetative propagation**

Recommended Books:(LatestEditions)

- AryaRL:FundamentalsofHorticulture, ICAR, New Delhi.
- SinghSP:AdvancesinHorticultureandForestry(Vol.1-9),Scientific Publishers
- NairB:FundamentalsofVegetableCropProduction,ICAR, New Delhi.
- SudRK:Hort-AgroProjectReports,ICAR, New Delhi.
- Kumar R:NurseryandPlantationPracticesinForestry,ICAR, New Delhi.

Reference Books

- SinghSP:ScientificHorticulture(Vol.2-10),Scientific Publishers
- Nath P:Sustainable Horticulture Development andNutritionSecurity,ICAR, New Delhi.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
HORT (A) 107.1		2	3	-	-	-	-	-	1	-	-	2
HORT (A) 107.2	3	2	3	-	-	2	2	2	-	-	3	2
HORT (A) 107.3	3	3	-	3	-	1	2	1	2	-	2	1
HORT (A) 107.4	-	-	-	-	-	3	-	-	2	-	1	
HORT (A) 107.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	SWAG 108

Course Title	INTRODUCTION TO FORESTRY			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeontheimportance of Forestry Sciences.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand Forestry as a subject
- Understandthe different categories of Forestry, objectives of Silviculture
- Learn the Indian Forest Policies
- Understand Forest re-generation
- Learn the scope and importance of Agro-forestry

CourseContent

UNIT– I **05Hours**

- Introduction – definitions of basic terms related to forestry
- 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, artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations; Crown classification; Tending operations – weeding, cleaning, thinning

Course Contents

UNIT-II **05 Hours**

- Mechanical, ordinary, crown and advance thinning
- Forest mensuration–objectives, diameter measurement, instruments used in diameter

measurement

- Non instrumental methods of height measurement–shadow and single pole method.
- Instrumental methods of height measurement; Geometric and trigonometric principles, instruments used in height measurement
- Tree stem form, form factor, form quotient, measurement of volume of felled and standing trees,

UNIT-III **05 Hours**

- Age determination of trees
- 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

UNIT-IV **05 Hours**

- Cultivation practices of two important fast growing tree species of the region.
- Identification of tree species
- Medicinal and aromatic plants, their scope farm scale cultivation
- Different groups of medicinal and aromatic plants
- Diameter measurements using calipers and tape

UNIT-V **05 Hours**

- Diameter measurements of forked, buttressed, fluted and leaning trees
- Height measurement of standing trees by shadow method, single pole method and hypsometer
- Volume measurement of logs using various formulae
- Nursery lay out, seed sowing, vegetative propagation techniques
- Forest plantations and their management

Recommended Books:(LatestEditions)

- SinghSP:AdvancesinHorticultureandForestry(Vol.1-9)
- NairB:FundamentalsofVegetableCropProduction, Scientific Publishers, Kalyani Publishers
- SudRK:Hort-AgroProjectReports, ICAR, New Delhi
- KumarV:NurseryandPlantationPracticesinForestry, ICAR, New Delhi
- SinghSP:ScientificHorticulture(Vol.2-10), ICAR, New Delhi
- Nath P:Sustainable Horticulture Development andNutritionSecurity, Scientific Publishers

Reference Books

- AryaRL:FundamentalsofHorticulture, Scientific Publishers
- SinghSP:AdvancesinHorticultureandForestry(Vol.1-9), Scientific Publishers
- NairB:FundamentalsofVegetableCropProduction, Scientific Publishers
- SudRK:Hort-AgroProjectReports, ICAR, New Delhi
- KumarV:NurseryandPlantationPracticesinForestry, Scientific Publishers
- SinghS.P:ScientificHorticulture(Vol.2-10), ICAR, New Delhi
- NathP:Sustainable Horticulture Development andNutritionSecurity, Kalyani Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
SWAG 108.1		2	3	-	-	-	-	-	1	-	-	1
SWAG 108.2	3	2	3	-	-	2	-	-	-	-	3	2
SWAG 108.3	3	-	-	3	-	1	-	-	-	-	2	2
SWAG 108.4	-	-	-	-	-	3	-	-	2	-	1	-
SWAG 108.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**AEX 109**			
Course Title	**RURAL SOCIOLOGY AND EDUCATION PSYCHOLOGY**			
Category				
LTP & Credits	L	T	P	Credits

	2		0	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon Rural Sociology and Psychology behind Extension Education

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand what is meant by Rural Sociology
- Understandthe difference between Sociology and Rural Sociology
- Learn the role of Sociology in Extension Education
- Understand concept of Rural Culture
- Learn the behaviour of an individual through , concept, cognitive, affective and psychomotor domain

CourseContent

UNIT– I **05Hours**

- **Rural Sociology:** Definition, scope and significance in Extension Education
- **Social Ecology:**Concepts, components and natural unplanned ecological entities
- **Rural Society:**Definition, characteristics, rural-urban differences, factors closing that gap
- **Social Group:**Definition, characteristics of group
- **Social Group:** Classification of group, stage of group formation

UNIT-II **05 Hours**

- **Social stratification:**Definition and function of Stratification
- **Social Stratification:** Types/forms of Stratification, caste system and class system
- **Cultural concept**: Concept of culture, customs, folkways, mores and taboos
- **Cultural concepts**: Rituals, tradition, norms and values.
- **Social Institution**: Definition and function, characteristics.

UNIT-III **05 Hours**

- **Important Institution:** The family, religion, economic, Government Education
- **Social change and Development:** Definition and characteristics of social change
- **Social Change:** Theories of social change, factor of social change

- **Social change:** Resistance to social change, social change and rural development
- **Education Psychology:** Meaning and its importance in Agricultural Extension

UNIT-IV **05 Hours**

- **Behaviour :** Concept, cognitive affective and Psychomotor Domain
- **Personality:** Definition, elements of personality
- **Personality:** Factors influencing growth and development of personality
- **Personality:** Concept of Introvert, Extrovert and Ambivert.
- **Personality:** Rural urban stigma

UNIT-V **05 Hours**

- **Learning:** Definition of learning, types, learning curve
- **Learning:** Theories of learning
- **Motivation:** Definition and concept, theories of Motivation
- **Intellegence:** Definition and types of intelligence
- **Intelligence: IQ,** Concept and classification of intelligence in Extension Education

Recommended Books:(LatestEditions)

- Ray G L: Extension Communication and Management, Kalyani Publishers
- Mandal G: Fundamentals of Agricultural Extension Education, Kalyani Publishers
- Singh A K, Dhaka B L, Duapare B U and Wasim A: Agricultural Extension, New Vishal Publications, New Delhi

Reference Books

- OakleP:GuidetoExtensionTraining, ICAR, New Delhi
- SinghAK:PioneerResearchinExtensionEducation, ICAR, New Delhi
- CholeRR:TransferofAgriculturalTechnology, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12

AEX 109.1	3	2	3	-	-	-	-	-	1	-	-	1
AEX 109.2	3	2	3	-	-	2	-	-	-	-	3	2
AEX 109.3	3	-	-	3	-	1	-	2	-	-	2	-
AEX 109.4	2	2	-	-	-	3	-	1	2	-	1	-
AEX 109.4	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**ENG 110**
Course Title	**COMPREHENSION AND COMMUNICATION SKILLS IN ENGLISH**
Category	

LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon Comprehension and Communication Skills in English

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Enrich in vocabulary
- Understandthe functional grammar dealing with Article, Preposition, Conjunction.
- Learn the Subject verb Agreement, Transformation
- Understand the Direct and Indirect Narration, writing skills
- Learn Report writing, Proposal writing, preparation of Curriculum Vitae and Job application

CourseContent

UNIT– I **05Hours**

- Reading comprehension, vocabulary, antonym, synonym, homophones, homonyms
- Enrichment in vocabulary
- Functional grammar
- Article, preposition, conjunction, verb, subject
- Transformation and synthesis

UNIT-II **05 Hours**

- Direct and indirect narration
- Written skills
- Paragraph writing
- Precise writing
- Report and Proposal writing.

UNIT-III **05 Hours**

- Importance of professional writing
- Preparation of curriculum vitae and job application

- Synopsis writing
- Interviews: kinds, importance and process

UNIT-IV **05 Hours**

- Listening Comprehension
- Listening to short talk, lecture, speeches (scientific, commercial and general)
- Oral communication: Phonetics, stress and intonation
- Conversation practice, politeness
- Conversation: Rate of speech, clarity of voice

UNIT-V **05 Hours**

- Speaking and listening, politeness
- Reading dialogues, rapid reading, intensive reading
- Improving reading skills
- Mock interviews: Testing initiative, team spirit, leadership, intellectual ability
- Group Discussions

Recommended Books:(LatestEditions)

- R. Gupta, English Reading Comprehension.
- Varinder Kumar and Bodh Raj,Comprehension and Communicative Skills in English.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
ENG 110.1	3	2	3	-	-	-	-	-	1	-	-	
ENG 110.2	3	2	3	-	-	2	-	-	-	-	3	
ENG 110.3	3	-	-	3	-	1	-	2	-	-	2	
ENG 110.4	-	-	-	-	-	3	-	1	2	-	1	
ENG 110.5	1	2	1	1	-	-	-	-	-	-	2	

Course Code	**AST 111**
Course Title	**ELEMENTARY MATHEMATICS**
Category	

LTP & Credits	L	T	P	Credits
	1		0	1
Total Contact Hours	20			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgehigher mathematics

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand basic ideas of Sets, set operations, Algebra of sets
- Understand the Determinants and Matrices
- Learn Integral and Differential Calculus
- Understand the Orthogonal Matrix, Rank and Equivalence
- Learn derivatives of logarithmic and exponential functions

CourseContent

UNIT– I **05Hours**

- Elementary Set Theory: Basic ideas of Sets Set operations
- **L**aws of Algebra of Sets, number of elements in a Set, Venn diagram, Cratesian product ofSets
- Definitions and ideas, Types of Matrices, Matrix operations
- Transpose, Symmetric and Skew symmetric matrices with properties
- Determinants, Properties of Determinants (without proof), minors and cofactors

UNIT-II **05 Hours**

- Product, Adjugate and reciprocal of determinants,
- Differentiation and Integration of determinants, Cramer's Rule
- Adjoint and Inverse of matrices,
- Orthogonal Matrix, Rank and Equivalence,
- Solution of system of Equations by Matrix method and rank method.

UNIT-III **05 Hours**

- **Differential Calculus:** Ideas of Functions(Different kinds of functions with examples)
- Limits and Continuity (No problems), Differentiation
- Derivative of polynomial and trigonometric functions, composite functions, chain rule
- Derivatives of inverse trigonometric functions, derivative of implicit functions.

- Derivatives of logarithmic and exponential functions. Logarithmic differentiation
- **Integral Calculus:** Indefinite integrals
- Method of substitution, Standard forms, Rules of integration
- Integration by parts, Partial fraction method
- Definite integral as limit of a sum and its geometrical interpretation,
- Fundamental theorem of integral calculus

UNIT-IV **05 Hours**

- Elementary properties of definite integrals.
- Evaluation of definite integrals
- Infinite Series: Sequences, Convergence of sequences
- infinite series of constant terms, Tests of convergence
- Comparison test, D'Alembert's ratio test, Cauchy's root test.

Recommended Books:(LatestEditions)

- Dorofeev:Elementary Mathematics, Selected Topics and Problem Solving, CBS Publishers
- Godsky V Y: Mathematical Handbook Elementary Mathematics, CBS Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AST 111.1	3	2	3	-	-	-	-	-	1	-	-	2
AST 111.2	3	2	3	-	-	2	-	-	-	-	3	2
AST 111.3	3	-	-	3	-	1	-	2	-	-	2	-
AST 111.4	-	-	-	-	-	3	-	1	2	-	1	-
AST 111.5	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**NSS 112**			
Course Title	**NATIONAL SERVICE SCHEME**			
Category				
LTP & Credits	L	T	P	Credits
	0		1	1

Total Contact Hours	15
Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon National Service Scheme (NSS).

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know the history, objectives, principles of NSS
- Understand the Organizational structure, NSS Code of conduct
- Learn NSS Programme and activities
- Understand the challenges and opportunities for youth, the agent for social change
- Learn the social harmony and national integration

CourseContent

UNIT-I **05 Hours**

- Orientation: History, objectives, principles, symbol, badge; regular programmes under NSS
- Organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health
- NSS programmes and activities
- Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey,
- Analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary.

UNIT-II **05Hours**

- Understanding youth: Definition, profile, profile, categories, issues and challenges of youth
- Opportunities for youth who is agent of the social change
- Community mobilization: Mapping of community stakeholders, designing the message as per tproblems and their culture; identifying methods of mobilisation involving youth-adult partnership
- Indian history and culture, role of youth in nation building, conflict resolution and peace-building Social harmony and national integration
- Volunteerism and shramdan: Indian tradition of volunteerism, its need, importance, motivation and constraints; **shramdan** as part of volunteerism

UNIT-III **05 Hours**

- Citizenship, constitution and human rights
- Basic features of constitution of India, fundamental rights and duties, human rights,
- Consumer awareness and rights and rights to information
- Family and society:Concept of family, community
- PRIs and other community-based organisations and society
-

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
NSS 112.1	3	2	3	-	-	-	-	-	1	-	-	
NSS 112.2	3	2	3	-	2	2	-	-	-	-	3	2
NSS 112.3	2	-	-	3	1	1	-	2	-	-	2	2
NSS 112.4	-	-	-	-	-	3	-	1	2	-	1	
NSS 112.5	1	2	1	1	-	-	-	-	-	-	2	

Course Code	**AGR 151**			
Course Title	**FUNDAMENTALS OF AGRONOMY II**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon soil and water resources in West Bengal and India, irrigation, physiological availability of water and water use efficiency.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn about water resources and irrigation development in India and West Bengal
- Understand their soil and climatic requirements, varieties, cultural practices
- Learn irrigation its definition and objectives, soil-plant-water relationship; soil moisture tension and retention, methods of moisture estimation, soil water classification: physical and biological, and soil water constants
- Understand water and irrigation requirement of different crops, and water use efficiency, evapo-transpiration,crop water requirement
- Irrigation scheduling and methods, irrigation efficiencies;quality of irrigation water; water logging and drainage; Definition: Tillage and tilth; different types of tillage, factors affecting tillage operations, modern concept of tillage.

CourseContent

UNIT– I **05Hours**

- Water resources and irrigation development in India and West Bengal
- Irrigation: definition and objectives
- Soil-plant-water relationship
- Soil moisture tension and retention
- Methods of moisture estimation

UNIT-II **05Hours**

- Soil water classification: physical and biological
- Soil water constants
- Water and irrigation requirement of different crops
- Water use efficiency

UNIT-III **05Hours**

- Evapo-transpiration
- Crop water requirement
- Irrigation scheduling and methods
- irrigation efficiencies
- Quality of irrigation water

UNIT-IV **05Hours**

- Water logging and drainage
- Tillage and tilth; different types of tillage
- Factors affecting tillage operations, modern concept of tillage.
- Study on soil moisture measuring devices
- Measurement of field capacity, bulk density and infiltration rate

UNIT-V **05 Hours**

- Measurement of irrigation water and determination of irrigation efficiency
- Calculation on water requirement
- Identification of weeds in crop fields and study on weed seed bank
- Cultural, mechanical and biological methods of eco-safe weed management;
- Calibration of sprayer, types of herbicides and application methodsPRIs and other community-based organisations
- Numerical exercise on herbicide and weed control efficiency

Recommended Books:(LatestEditions)

- DasN.R:IntroductiontoCropsofIndia.2nd, Scientific Publishers
- JatML:DrylandTechnology2ndEd. ICAR, New Delhi
- Khare D: Farm Mechanization for Production ofPulses, Kalyani Publishers
- GhoshP.K:ResourceConservationTechnologyinPulses, Scientific Publishers
- SharmaA.R:ResourceConservingTechniquesinCropProduction, ICAR, New Delhi

Reference Books

- FAO Hand Book:TheUseofSalineWatersforCropProduction, FAO, Rome
- DasNR:WheatCropManagement, Scientific Publishers
- DasNR:GlossaryofIndianCrops, Scientific Publishers
- KhareD:FarmMechanizationforProduction, ICAR, New Delh

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AGR 151.1	3	2	3	-	-	-	-	-	1	-	-	
AGR 151.2	2	2	3	-	-	2	-	-	-	-	3	
AGR151.3	2	-	3	3	-	1	-	2	-	-	2	
AGR 151.4	2	-	-	-	-	3	-	1	2	-	1	
AGR 151.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	AGR 152

Course Title	CROP PRODUCTION TECHNOLOGY I (*RABI CROPS*)			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon the technology of crop production (*Rabi crops*)

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn about origin, geographical distribution of *Rabi*crops (winter crops)
- Understandthe economic importance of such crops
- Understand theirsoil and climatic requirements, varieties, cultural practices
- Understand the production technology ofcereals – wheat and barley, pulses- chickpea, lentil, peas, lathyrus, french bean; oilseeds- rapeseed and mustard, sunflower and linseed
- Understand the productivity and economic profitability of Commercial crop- tobacco.

CourseContent

UNIT– I **05 Hours**

- Origin, geographical distributionof winter season crops
- Economic importance
- Varieties, cultural practices and yield of *Rabi* crops
- Production technology of winter cereals wheat and barley
- Pulses- chickpea, lentil, peas, lathyrus, French bean

UNIT-II **05 Hours**

- Water and irrigation requirement of different crops

- Commercial crop Tobacco
- Field preparation, sowing of *rabi* cereals, pulses, oilseed crops and tobacco
- Concept of multiple cropping systems
- Calculation on seed rate and fertilizers

UNIT-III **05 Hours**

- Use of bio-fertilizers, top dressing of nutrients
- Important cultural operations and water management
- identification of weeds and their control measures
- Morphological and yield attributing characteristics
- Estimation of yield

UNIT-IV **05 Hours**

- Harvesting, threshing, winnowing and storage of *rabi* field crops
- Cost of cultivation;
- Factors affecting tillage operations, modern concept of tillage.
- Study on soil moisture measuring devices
- Crop distribution in West Bengal and its ecological regions

UNIT-V **05 Hours**

- Measurement of irrigation water and determination of irrigation efficiency
- Visit to research stations for related multiple cropping.
- Identification of weeds in crop fields and study on weed seed bank
- Cultural, mechanical and biological methods of eco-safe weed management;
- Numerical exercise on herbicide and weed control efficiency

Recommended Books:(LatestEditions)

- DasNR:IntroductiontoCropsofIndia Scientific Publishers
- JatML:DrylandTechnology2ndEd. ICAR, New Delhi
- Khare D: Farm Mechanization for Production ofPulses, ICAR, New Delhi

- Ghosh,P.K.:ResourceConservationTechnologyinPulsesScientific Publishers
- SharmaA.R.:ResourceConservingTechniquesinCropProduction, ICAR, New Delhi

Reference Books

- FAO:TheUseofSalineWatersforCropProduction, ICAR, New Delhi
- DasNR:WheatCropManagement, Scientific Publishers
- DasNR:GlossaryofIndianCrops, ICAR, New Delhi
- Khare,D.:FarmMechanizationforProduction, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AGR 152.1	3	2	3	-	-	-	-	-	1	-	-	2
AGR 152.2	3	1	2	-	-	2	-	2	-	-	3	1
AGR152.3	2	-	3	3	-	1	-	2	-	-	2	-
AGR152.4	2	3	-	-	-	3	-	1	2	-	1	-
AGR 152.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**ACSS 153**
Course Title	**FUNDAMENTALS OF SOIL SCIENCE II**

Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon physical and chemical properties of soil with special emphasis on soil organic matter

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the soil organic matter, the key constituent of soil.
- Understand properties of Humus and its influence on soil properties
- Learn the properties of humic substances
- Learn about soil macro- and microorganisms and the beneficial and harmful effect
- Understand soil pollution - behaviour of pesticides and inorganic contaminants

CourseContent

UNIT– I **05 Hours**

- Organic matter, and its composition
- Properties of soil organic matter
- Its influence on soil properties
- Humic substances, nature and properties
- Soil organisms (macro-and microorganisms)

UNIT-II **05 Hours**

Beneficial and harmful effect of soil microorganisms

Soil pollution - behaviour of pesticides and inorganic contaminants

- Prevention and mitigation of soil pollution
- Quality of irrigation water and its appraisal
- Indian standard for water quality

UNIT-III **05 Hours**

- Use of saline water for irrigation/agriculture
- Important cultural operations and water management
- Different approaches for soil fertility evaluation
- Soil testing–chemical methods
- Critical levels of nutrients in soil and plants,

UNIT-IV **05 Hours**

- DRIS method
- Biological method of soil fertility evaluation.
- Nutrient use efficiency.
- Analytical instruments and their calibration and applications
- Colorimetry and flame photometry.

UNIT-V **05 Hours**

- Estimation of available N, P, K, S and Zn in Soils
- pH, EC, soluble cations and anions in soil water extracts
- Estimation of N, P, K, and S in soil and plants
- Rapid soil test
- Soil test crop response correlation

Recommended Books:(LatestEditions)

- Das D K:Introductory Soil Science, 2nd Edition, Kalyani Publishers, New Delhi
- Rattan R K, Katyal J C, Dwivedi B ,Sarkar A K, Bhattacharya T, Tarafdar J C and Kukal S S: Soil Science-An Introduction, Indian Society of Soil Science, New Delhi

- Goswami N N, Rattan R K, Dev G, Narayanasamy G, Das D K, Sanyal S K, Pal D K and and Rao D L N: Fundamentals of Soil Science, , 2nd Edition, Indian Society of Soil Science, New Delhi.
- Arya R L: FundamentalsofSoilScience, Indian Council of Agricultural Research, New Delhi.
- JacksonML:SoilChemicalAnalysis:Prentice Hall of India Ltd, New Delhi
- Piper,CS:SoilandPlantAnalysis.New York: Interscience Publishers, Inc.
- Ryan,J:SoilandPlantAnalysis:LaboratoryManual, USDA, Maryland

Reference Book

- BearFE:ChemistryofTheSoil,2ndEd. Scientific Publishers.
- USDA:SoilSurveyManualNewRevisedEd.
- FAO:TheUseofSalineWatersforCropProduction, Rome, Italy
- GuptaSK:StandardMethodsforAnalysisofSoilPlantandWater, Academic Publishers
- FriedM:TheSoil-PlantSysteminRelationtoInorganicNutrition,Academic Press, USA.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AEN 153.1	2	2	3	-	-	-	-	-	1	-	-	2
AEN 153.2	3	1	3	-	-	2	-	2	-	-	3	1
AEN153.3	3	-	2	3	-	1	-	2	-	-	2	1
AEN 153.4	2	3	-	-	-	3	-	1	2	-	1	-
AEN 153.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**AEN 154**			
Course Title	**FUNDAMENTALS OF AGRICULTURAL ENTOMOLGY II**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon physical and chemical properties of soil with special emphasis on soil organic matter

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn ecology, definition and its biotic & abiotic components.Effect of abiotic factors- temperature, RH, rainfall, light, atmospheric pressure & air current. Effect of biotic factors- intra & inter specific relationship, food competition
- Understand natural and environmental resistance.Concept and definition of Pests, its categorization.Insects and mite pests of crops.Survey and surveillance, sampling, and estimation of pest population.
- Learn classification of tools and their application in IPM system.Bio-control agents including predators, parasitoids, mite predators, microbial and their application in IPM
- Understand Insecticides act 1968- important provisions. Application techniques of spray fluids- high, low and ultra-low volume spray. Symptoms of poisoning- first aids and antidotes for important group of insecticides.
- Study distribution pattern of insects in crop ecosystem.Sampling techniques for the estimation of insect population and damage.Habit, habitat, distribution, sampling and identification of mite pests

CourseContent

UNIT– I **04 Hours**

- Ecology:definition and its biotic and abiotic components
- Effect of abiotic factors viz. temperature, relative humidity, rainfall, light, atmospheric pressure and air current.
- Biotic factors and their intra and inter specific relationships
- Food competition
- Natural and environmental resistance

UNIT-II **04 Hours**

- Concept and definition of Pests, its categorization
- Survey and surveillance, sampling, and estimation of pest population
- Concept and definition of Integrated Pest Management (IPM), importance, principles
- Tools of IPM
- Bio-control agents including predators, parasitoids, mite predators, microbial and their application in IPM

UNIT-III **04 Hours**

- Chemical control- definition, importance, hazards and limitations.
- Classification of insecticides,
- Label and formulation of insecticides
- Synthetic chemical insecticides in plant protection
- Botanical insecticides- definition, scope and limitation of botanicals

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UNIT-IV **04Hours**.

- Recent methods of pests control- repellents, antecedents, sex pheromones and IGRs
- Application techniques of spray fluids- high, low and ultra-low volume spray
- Insecticideact 1968- Important provisions
- Symptoms of poisoning- first aids and antidotes for important group of insecticides.

- Microbial insecticides

UNIT-V **04 Hours**

- Study of distribution pattern of insects in crop ecosystem.Sampling techniques for the estimation of insect population and damage.
- Habit, habitat, distribution, sampling and identification of mite pests.Insecticides act 1968- Important provisions
- Survey on pest s and forecasting of pest incidence.Pest surveillance through light trap, pheromone traps and forecasting of pest incidence
- Identification of pests and their estimation.Identification of bio-control agents and their qualitative and quantitative estimation
- Label and toxicity of insecticides

UNIT VI **04 Hours**

- Acquaintance of insecticides formulations.Calculation of doses/concentration of different insecticides Application techniques of spray fluids- high, low and ultra-low volume spray
- Plant protection equipment and spray droplet size
- Compatibility of pesticides with other agro-chemicals and phytotoxicity of insecticides.
- Study of insect pollinators, weed killers and scavengers
- Commonly used acaricides, rodenticidesand nematicides. Microbial insecticides and IGRs.Application of IPM techniques, integration and case studies

Recommended Books:(LatestEditions)

- Ragumoorthi K N, Balasubramani V, Srinivasan M R and Natarajan N: Insecta – An Introduction AE Publications
- Prasad T V: Handbook of Entomology, New Vishal Publications
- Dhaliwal G S, Singh R and Jindal V: A Textbook of Integrated Pest Management, Kalyani Publishers

Reference Books

- Reddy D S: Applied Entomology,New Vishal Publications
- Vasantharaj B and Ramamurthy V V: Elements of Economic Entomology (8th Edition) . Brillion Publishing
- Walia R K and Bajaj H K: Textbook of Introductory Plant Nematology Indian Council of Agricultural Research, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AEN 154.1	2	2	3	-	-	-	-	-	1	-	-	
AEN 154.2	3	1	3	-	-	2	-	2	-	-	3	
AEN154.3	3	-	2	3	-	1	-	2	-	-	2	
AEN 154.4	2	3	-	-	-	3	-	1	2	-	1	
AEN 154.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	**PPA 155**
Course Title	**FUNDAMENTALS OF PLANT PATHOLOGY II**

Category				
LTP & Credits	L	T	P	Credits
	2		0	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledge onhistory of Plant Pathology with special reference to the Indian workand importance of plant diseases, scope and objectives of the subject.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know the history of Plant Pathology
- Understand the Terms and concepts in Plant Pathology and Pathogenesis.
- Understand the cause and classification of plantdiseases
- Learn the diseases and symptoms due to abiotic causes.
- Understand the role of enzymes, toxin, growth regulators and polysaccharides

CourseContent

UNIT– I **05Hours**

- History of Plant Pathology with reference to Indian conditions
- Importance of plant diseases, scope and objectives
- Cause and classification of plantdiseases
- Natural and environmental resistance
- Diseases and symptoms due to abiotic causes

UNIT-II **05 Hours**

- Concept and definition of Pests, its categorization
- Survey and surveillance, sampling, and estimation of pest population

- Terms and concept of Plant Pathology
- Pathogenesis

UNIT-III **05Hours**

- Chemical control- definition, importance, hazards and limitations.
- Pathogenesis – Role of enzymes, toxin, growth regulators and polysaccharides
- Défense mechanism in plants
- Structural and biochemical (pre and post infection) mechanisms
- Plant disease epidemiology

.

UNIT-IV **05Hours**.

- Phenomenon of infection
- Pre penetration, penetration and post penetration
- Plant disease forecasting, remote sensing
- Principles and methods of plant disease management.
- Application of Biotechnology in plant disease management

UNIT-V **05 Hours**

- Development of disease resistant transgenic plants through gene cloning
- IDM concept, advantage and importance
- Microbial disease control methods
- Nature, chemical combination, classification, mode of action
- Formulations of fungicides and antibiotics

Recommended Books:(LatestEditions)

- Singh R S: Introduction to Principles of Plant Pathology (5th Edition),Oxford & IBH Publishing Company PVT. LTD.
- Singh R S: Plant Diseases (10th Edition) Oxford & IBH Publishing Company PVT. LTD.
- Rangaswami G and Mahadevan A: Disease of Crop plants in India (4th Edition) Prentice Hall India Learning Pvt. Ltd, New Delhi

Reference Books

- Mehrotra R S and Agarwal A: Fundamentals of Plant Pathology Mc Graw Hill Education Private Limited, New Delhi.
- Dube H C: AnIntroductiontoFungi,4thEd. ICAR, New Delhi
- Bajaj H K: HandbookofPracticalNematology,Scientific Publishers.
- Reddy P: TextBookofIntroductoryPlant Nematology.P Reddy, ICAR, New Delhi
- Gour H N: AnnualReviewofPlantPathology(1-6), ICAR, New Delhi.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
PPA 155.1	2	2	3	-	-	-	3	-	1	-	-	2
PPA 155.2	3	1	3	2	-	2	-	2	-	-	3	-
PPA155.3		-	2	3	-	1	2	2	-	-	2	-
PPA155.4	2	3	-	-	-	3	-	1	2	-	1	2
PPA 155.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	**GPB 156**
Course Title	**FUNDAMENTALS OF GENETICS**

Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledge onPre and Post Mendelian concepts of heredity, Mendelian principles of heredity and crop improvement.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know Mendelian concept of heredity
- Understand the architecture of chromosome, chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes
- Learn about mutation and crop improvement
- Learn linkage and its estimation, crossing over mechanisms, chromosome mapping
- Learn Qualitative and Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis

CourseContent

UNIT– I **06 Hours**

- Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity,
- Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes.
- Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis
- Probability and Chi-square
- Dominance relationships, Epistatic interactions
- Multiple alleles, pleiotropism and pseudoalleles,

UNIT-II **06Hours**

- Sex determination and sex linkage, sex limited and sex influenced traits
- Blood group genetic
- Linkage and its estimation, crossing over mechanisms, chromosome mapping
- Structural and numerical variations in chromosome and their implications
- Use of haploids, diploids and doubled haploids in Genetics

UNIT-III **06Hours**

- Mutation, classification, Methods of inducing mutations and CIB technique
- Mutagenic agents and induction of mutationDéfense mechanism in plants
- Qualitativeand Quantitative traits
- Polygenes and continuous variations, multiple factor hypothesis
- Cytoplasmic inheritance

UNIT-IV **06 Hours.**

- Geneticdisorders nature, structure and replication of genetic material.
- Protein synthesis
- Transcription and translational mechanism of genetic material,
- Gene concept: Gene structure,
- Function and regulation, Lac and Trp operons.

UNIT-V **06 Hours**

- Study of microscope.Study of cell structure. Mitosis and Meiosis cell division. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross
- Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division.
- Experiments on probability and Chi-square test
- Determination of linkage and cross-over analysis (through two point test cross and three point test cross data)

- Study on sex linked inheritance in Drosophila.
- Study of models on DNA and RNA structures

Recommended Books:(LatestEditions)

- Singh B D: Genetics (3rd Edition) , Kalyani Publishers
- Singh B D: A Textbook of Plant Breeding, Kalyani Publishers
- Strickberger M W: Genetics (3rd Edition) Prentic Hall of India Private Limited
- Singh B D: Plant Breeding- Principles and Methods, Kalyani Publishers
- SharmaAK:CropImprovementandMutationBreeding, ICAR, New Delhi

Reference Books

- SinghC:GeneticImprovementofFieldCrops, Kalyani Publishers
- ChakrabortyS:PlantMolecularGenetics, Scientific Publishers
- DwivediP:PlantTissueCulture, ICAR, New Delhi
- KumarS:PlantTissueCulture:Theory&Techniques, ICAR, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
GPB 156.1	2	2	3	-	1	-	-	-	1	-	-	2
GPB 156.2	3	1	3	3	2	2	-	2	-	-	3	1
GPB156.3		-	2	3	3	1	2	2	-	-	2	1
GPB 156.4	2	3	-	-	-	3	1	1	2	-	1	-
GPB 156.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**PPH157**
Course Title	**FUNDAMENTAL OF CROP PHYSIOLOGY**

Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledge different physiological and metabolic functions for plant growth.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the role of water in plant metabolism, diffusion and osmosis, imbibition, water potential and its components, absorption of water, stomata structure and physiology, transpiration.
- Learn the nutrition of plants: essentiality,functions and deficiency symptoms of nutrients, nutrient uptake mechanisms.
- Understand Photosynthesis, structure and function of chloroplast, Light and Dark reactions, cyclic and non-cyclic electron transfer
- Understand Photorespiration and its implication.Respiration: Glycolysis, TCA cycle and electron transport chain;
- Learn the Plant growth regulators: Physiological roles and use in agricultural and horticultural crops;

CourseContent

UNIT– I **05Hours**

- Role of water in plant metabolism, diffusion and osmosis
- Imbibition, water potential and its components, absorption of water
- Stomata structure and physiology, transpiration
- Mineral nutrition of plant
- Essentiality, Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms.

UNIT-II **05Hours**

- Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms.
- Photosynthesis: Structure and function of chloroplast
- Light and Dark reactions, cyclic and non-cyclic electron transfer
- CO_2fixation:C_3, C_4 and CAM plants
- Photorespiration and its implications.

UNIT-III **05Hours**

- Respiration: Glycolysis, TCA cycle and electron transport chain
- Plant growth regulators
- Physiological roles and use in agricultural and horticultural crops; Growth analysis, role of physiological growth parameters in crop productivity, physiological
- Physiological aspects of growth and development of major crops
- Secondary metabolites: Brief introduction; major classes of secondary metabolites with examples and their roles in plant defence.

UNIT-IV **05Hours**.

- Preparation of solutions and buffers..
- Study of plant cells
- Structure and distribution of stomata.
- Imbibition, osmosis, plasmolysis
- Function and regulation, Lac and Trp operons.

UNIT-V **05 Hours**

- Determination of osmotic potential of tissue.
- Separation of photosynthetic pigments through paper chromatography
- Rate of transpiration, rate of photosynthesis,
- rate of respiration, effect of respiratory inhibitor
- Estimation of relative water content.
- Study of deficiency symptoms of mineral nutrients

Recommended Books:(LatestEditions)

- Jain V K: Fundamentals of Plant Physiology, S Chand & Co. Ltd.
- Verma S K and Verma M:A Textbook of Plant Physiology, Biochemistry & Biotechnology S Chand & Co. Ltd.

- Kochhar S L and Gujral S K: Plant Physiology- Theory and Applications, Cambridge University Press
- GardnerFP:PhysiologyofCropPlants., Scientific Publishers, Jodhpur
- RajendranC:NutritionalandPhysiologicalDisordersinCropPlants, ICAR New Delhi
- HemantaranjanA:PhysiologicalEfficiencyforCropImprovement, Scientific Publishers

Reference Books

- BalintA:PhysiologicalGeneticsofAgriculturalCrops, Academic Press
- HemantaranjanA:PhysiologyofNutritionandEnvironmental StressesOnCrop Productivity, Scientific Publishers
- NarwalSS:PlantAnalysisResearchMethods, Kalyani Publishers
- HemantaranjanA:PlantPhysiologyandPlantMolecularBiologyinNew Millennium,Scientific Publishers
- NarwalSS:PlantPhysiologyResearchMethods
- HemantaranjanA:PlantPhysiologyUnderChangingEnvironment, Scientific publishers
- HemantaranjanA:PlantStressTolerancePhysiological&MolecularStrategies, Scientific publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
PPH 157.1	2	2	3	-	2	-	-	-	1	-	-	2
PPH 157.2	3	1	3	3	2	2	-	2	-	-	3	2
PPH157.3		-	2	3	-	1	2	2	-	-	2	1
PPH 157.4	2	3	-	-	-	3	1	1	2	-	1	-
PPH 157.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**AEC 158**
Course Title	**FUNDAMENTALS OF AGRICULTURAL ECONOMICS**

Category				
LTP & Credits	L	T	P	Credits
	2		0	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand Economics:meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis
- Learn the nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behaviour.
- Understand the basic concepts: goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.
- Understand Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus
- Understand the elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship.

CourseContent

UNIT– I **05Hours**

- Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis
- Micro and macro economics, positive and normative analysis
- Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behaviour.

- Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.
- Meaning, definition and characteristics of agriculture and horticulture, importance and its role in economic development

UNIT-II **05 Hours**

- Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms Agricultural and horticultural planning for development of the country.
- Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle
- Consumer's equilibrium and derivation of demand curve, concept of consumer surplus Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity
- Production: process, creation of utility, factors of production, input output relationship.

UNIT-III **05 Hours**

- Laws of returns: Law of variable proportions and law of returns to scale.
- Cost: Cost concepts, short run and long run cost curves
- Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply
- Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets
- Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break-even points.

UNIT-IV **05Hours**.

- Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.
- National income: Meaning and importance, circular flow, concepts of national income

accounting and approaches to measurement, difficulties in measurement

- Concept of money and inflation.
- Population: Importance, Malthusian and Optimum population theories
- Natural and socio-economic determinants, current policies and programmes on population control.

UNIT-V **05 Hours**

- Tax: public revenue and public expenditure meaning
- Direct and indirect taxes, agricultural taxation, VAT
- Economic systems: Concepts of economy and its functions
- Important features of capitalistic, socialistic and mixed economies
- elements of economic planning.

Recommended Books:(LatestEditions)

- Subba Reddy, Raghu Ram P, Neelkanta T V , Sastry I and Devi B: Agricultural Economics (2nd Edition) Oxford & IBH Publishing Co Pvt. Ltd
- Pradasd S V S, Srinivas K, Kumar V, and Kantwa S R;Agricultural Economics (2nd Edition) New Vishal Publications
- Agricultural Finance and Management S. Subba Reddy, P. Raghu Ram Oxford & IBH Publishing Co PVT. Ltd

Reference Books

- Yadav,S.L.:AgriculturalPlanninginIndia, ICAR, New Delhi
- Chole,R.R.:EntrepreneurshipDevelopmentandCommunicationSkills , Newage Publications.
- Khan,D.:EntrepreneurshipinFarming, ICAR, New Delhi
- Diwase,S.:IndianAgriculture&AgribusinessManagement,3rdEd., ICAR, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
AEC 158.1	2	2	3	-	2	-	3-	-	1	-	-	
AEC 158.2	3	1	3	3	-	2	-	2	-	-	3	2
AEC 158.3	1	-	2	3	-	1	2	2	-	-	2	2
AEC 158.4	2	3	-	-	-	3	1	1	2	-	1	-
AEC 158.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**AEX 159**

Course Title	FUNDAMETALS OF AGRIL EXTENSION EDUCATION			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledge ofrural sociology and informal rural education for disseminating the technologies to the masses.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept, meaning, scope, objective and principles of Extension Education
- Learn the history of Agricultural Extension Education in India
- Understand the concept, meaning and definition of Rural Development
- Acquaint with various rural development programmes launched by Govt. of India, time to time
- Understand Community Development, meaning, definition, concept, principles, and Philosophy

CourseContent

UNIT– I **06Hours**

- Extension Education- meaning, definition, scope and process
- Objectives and principles of Extension Education;
- Extension Programme planning, Meaning, Process
- Principles and Steps in Programme Development
- Extension systems in India: extension efforts in pre-independence era and post-independence era

UNIT-II **06 Hours**

- Various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.).
- New trends in agriculture extension: privatization extension,
- Rural Development: concept, meaning, definition

- Various rural development programmes launched by Govt. of India.
- Community Dev.-meaning, definition, concept & principles

UNIT-III **06 Hours**

- Philosophy of Community Development
- Rural Leadership: concept and definition, types of leaders in rural context
- Extension administration: meaning and concept, principles and functions
- Monitoring and evaluation of extension programmes
- Transfer of technology: concept and models,

UNIT-IV **06 Hours**.

- Capacity building of extension personnel..
- Agriculture journalism
- Diffusion and adoption of innovation
- Concept and meaning, process and stages of adoption,
- Adopter categories

UNIT-V **06 Hours**

- Acquaintance with university extension system
- Group discussion- exercise; Handling and use of audio visual equipments and digital camera and LCD projector
- Preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories
- Presentation skills exercise; micro teaching exercise;
- Visit to village to understand the problems being encountered by the farmers.
- Study the organization and functioning of DRDA and other development departments at district level
- Visit to NGO and learning from their experience in rural development
- Understanding PRA techniques and their application in village development planning.

Recommended Books:(LatestEditions)

- RoyG L: Extension Communication and Management, Kalyani Publishers
- Mandal S: Fundamentals of Agricultural Extension Education Kalyani Publishers
- Singh A K, Dhaka B U and Duapare A W: Agricultural Extension, New Vishal Publications, New Delhi.

Reference Books

- OakleyPO:GuidetoExtensionTraining, ICAR, New Delhi
- SinghAK:PioneerResearchinExtensionEducation,New Age Publications
- CholeRR:TransferofAgriculturalTechnology, Scientific Publishers.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
NSS 159.1	2	2	3	-	-	-	-	-	1	-	-	
NSS 159.2	3	1	3	3	-	2	-	2	-	-	3	
NSS159.3		-	2	3	-	1	2	2	-	-	2	
NSS 159.4	2	3	-	-	-	3	1	1	2	-	1	
NSS 159.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	SWC 160			
Course Title	SOIL AND WATER CONSEVATION			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamentalknowledgeon soil and water conservation through natural resource management

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept of soil and water conservation
- Learn the definition of soil erosion and agents of soil erosion and different forms of water erosion
- Understand the Universal soil loss equation; Soil loss measurement techniques
- Learn concept of wind erosion and type of wind erosion
- Understand Water Harvesting and its techniques

CourseContent

UNIT– I **05Hours**

- Introduction to soil and water conservation
- Causes of soil erosion
- Definition of soil erosion and agents of erosion
- Different forms of water erosion
- Classification of gully erosion and control measures

UNIT-II **05 Hours**

- Universal soil loss equation
- Soil loss measurement techniques
- Principles of erosion control
- Introduction to contouring and strip cropping
- Contour bund, graded bund and bench terracing

UNIT-III **05 Hours**

- Grassed water ways and their design
- Water harvesting and its techniques
- Wind erosion : Mechanics of wind erosion
- Types of soil movement by wind
- Principles of wind erosion controland control measure

UNIT-IV **05Hours**.

- Mechanics of Wind erosion
- Principles of wind erosion control
- Diffusion and adoption of innovation
- Different control measures for wind erosion.
- Erosion Control measures

UNIT-V **05 Hours**

- General status of soil conservation in India
- Calculation of Erosion
- Measurement of Soil
- Loss.Preparation of contour maps
- IndexEstimation of Soil Loss;
- Design of grassed water ways
- Design of contour bunds
- Design of graded bunds.
- Design of bench terracing system.
- Problems of wind erosion.

Recommended Books:(LatestEditions)

- Suresh R :Soil and Water Conservation Engineering. Standard Publishers Distributors
- Mal B C: Introduction to Soil and Water Conservation Engineering Agrobios India

Reference Books

- Panda S C:Principles and Practices of water management Agrobios, India
- Monikanta B: Soil and water conservation engineering & practices Notion Press, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
SWC 160.1	2	2	3	-	2	-	-	2	1	-	-	2
SWC160.2	3	1	3	3	2	2	-	2	-	-	3	1
SWC160.3	1	-	2	3	-	1	2	2	-	-	2	1
SWC 160.4	2	3	-	-	-	3	1	1	2	-	1	-
SWC 160.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	**ASC 161**			
Course Title	**LIVESTOCK AND POULTRY MANAGEMENT**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	35			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on animal husbandary, their importanceon Indian perspective.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the role of livestock in the national economy
- Learn about important exotic and Indian breeds of cattle, buffalo, sheep, goat and pig.
- Know aboutanimal products like milk, its composition, biosynthesis and let-down, factors affecting yield and composition of milk, clean milk production nutritive value of egg.
- Learn the diseases of livestock and poultry and their control measures
- Realize the economics of livestock and poultry production.

CourseContent

UNIT– I **07Hours**

- Role of livestock in the national economy.
- Important exotic and Indian breeds of cattle, buffalo, sheep, goat and pig.
- Selection and breeding of livestock and poultry for improved production.
- General information about reproductive behavior (like oestrus, gestation, parturition) and artificial insemination.
- Measures to improve reproductive efficiency.

UNIT-II **07 Hours**

- Feeds and feeding of different categories of farm animals
- Housing principles, space requirements for different species of livestock

- Care and Management of animals
- Animal productsmilk, its composition
- Biosynthesis and let-down

UNIT-III **07 Hours**

- Factors affecting yield and composition of milk, clean milk production; nutritive value of egg
- Introduction to livestock and poultry diseases
- Wind erosion : Mechanics of wind erosion
- prevention (including vaccination schedule) and control of important diseases of livestock and poultry.
- Important breeds of poultry, their systems of rearing, feeding management and hatching of egg.

UNIT-IV **07Hours**.

- External body parts of cattle, buffalo, sheep, goat, swine and poultry
- Handling and restraining of livestock
- Identification methods of farm animals and poultry
- Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records.
- Layout of housing for different types of livestock

UNIT-V **07Hours**

- Formulation of concentrate mixtures
- Thumb rule method of feeding dairy cows.
- Thumb rule method of feeding dairy cows.
- Determination of common adulterant of milk.
- Structure of egg, selection of eggs for hatching
- Hatchery operations, incubation and hatching equipments.
- Management of chicks, growers and layers.

- Methods of drug administration including vaccination.
- Economics of dairy and poultry farm.
- Problems of wind erosion.

Recommended Books:(LatestEditions)

- Sastry NSR and Thomas CK: Livestock Production Management, Kalyani Publishers
- Banerjee G C: A Textbook of Animal Husbandry, Oxford and IBH Publishers
- GhoshNilotpal:Livestock Production Management,PHI Learning Pvt. Ltd.
- Handbook of Animal Husbandry, ICAR, New Delhi

Reference Books

- Ghosh Nilotpal: Poultry Science and Practice (A Textbook), CH publishers
- R A Singh: Poultry Production, Kalyani Publishers
- Singh R R and Islam M: Poultry Science, New India Publishing Agency

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
ASC 161.1	2	2	3	-	-	-	-	-	1	-	-	2
ASC 161.2	3	1	3	3	-	2	-	2	-	-	3	1
ASC161.3		-	2	3	-	1	2	2	-	-	2	1
ASC 161.4	2	3	-	-	-	3	1	1	2	-	1	-
ASC 161.5	3	2	1	1	-	-	-	-	-	-	2	-

SEMESTER III

Course Code	AGR 201

Course Title	CROP PRODUCTION TECHNOLOGY II (*KHARIF CROPS*)			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	28			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on technology of crop productivity and production

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Knowthe origin, geographic distribution, economic importance, soil and climatic requirement of *Kharif crops*
- Learn about production technology of Cereals: Rice, Maize, Sorghum, Pearl millet and Minor millets
- Understand the cultural practices viz, time, tillage, fertilizer, crop protectant etcof Kharif crops
- Understand the crop management practices of Pulses like Pigeonpea, Mungbean and Urdbean
- Realize the cost of cultivation of the kharif ctops

CourseContent

UNIT– I **07Hours**

- Origin, geographic distribution, economic importance of the Kharifcrops
- Selection and breeding of livestock and poultry for improved production.
- Soil and climatic requirement, varieties, cultural practices and yield of *kharif*crops
- Cereals: Rice, Maize, Sorghum, Pearl millet and Minor millets
- Pulses: Pigeonpea, Mungbean and Urdbean

UNIT-II **07 Hours**

- Nursery preparation, sowing and transplanting of rice
- Field preparation and sowing of *kharif*cereals and pulse crops including inter / mixed cropping
- Calculations on seed rate, effect of seed size and sowing depth on germination, seedling vigour of *kharif* field crops
- Calculations on fertilizers
- Top dressing, and foliar feeding of nutrients

UNIT-III **07 Hours**

- Identification of weeds and their control measures
- Important intercultural operations and water management in *kharif*crops
- Morphological and yield attributing characteristics
- Estimation of yield, harvesting, threshing, winnowing and storage of *kharif* field cropsImportant breeds of poultry, their systems of rearing, feeding management and hatching of egg.

UNIT-IV **07Hours**.

- Cost of cultivation; Crop distribution in West Bengal and its ecological regions
- Study of crop varieties and important agronomic experiments at experimental farms
- Visit to research stations for related *kharif* crops and multiple cropping.
- Post-harvest management of the grains
- Use of pesticides rodenticides

Recommended Books:(LatestEditions)

- DasNR:IntroductiontoCropsofIndia.2nd, ICAR, New Delhi
- JatML:DrylandTechnology2ndEd. ICAR, New Delhi
- Khare D: Farm Mechanization for Production ofPulses, ICAR, New Delhi

- GhoshPK:ResourceConservationTechnologyinPulses, ICAR, New Delhi
- SharmaAR:ResourceConservingTechniquesinCropProduction, ICAR, New Delhi

Reference Books

- FAO Hand Book:TheUseofSalineWatersforCropProduction, Rome, Italy
- DasNR:WheatCropManagement, Scientific Publishers
- DasNR:GlossaryofIndianCrops, ICAR, New Delhi
- KhareD:FarmMechanizationforProduction, Scientific Publishers

CO PO MAPPING

• Course Outcome	• Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
AGR 201.1	2	2	3	-	-	-	-	-	1	-	-	2
AGR 201.2	3	1	3	3	2	2	-	2	-	-	3	2
AGR 201.3		-	2	3	2	1	2	2	-	-	2	1
AGR 201.4	2	3	2	2	-	3	1	1	2	-	1	-
AGR 201.5	3	2	1	1	-	-	-	-	-	-	2	1

Course Code	**GPB 202**			
Course Title	**FUNDAMENTALS OF PLANT BREEDING**			
Category				
LTP & Credits	L	T	P	Credits

	2		1	3
Total Contact Hours	32			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on plant breeding aiming at improved varieties with single trait or multiple traits.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know historical development, concept, nature and role of plant breeding,
- Understand the major achievements and future prospects; Genetics in relation to plant breeding,
- Understand the major achievements and future prospects;
- Know about Domestication, Acclimatization and Introduction of crops
- Know theCentres of origin/diversity, components of Genetic variation, Heritability and genetic advancement

CourseContent

UNIT– I **04Hours**

- Historical development, concept, nature and role of plant breeding
- Major achievements and future prospects;
- Genetics in relation to plant breeding, modes of reproduction and apomixes
- Self-incompatibility and male sterility- genetic consequences, cultivar options
- Domestication, Acclimatization and Introduction

UNIT-II **04 Hours**

- Centres of origin/diversity, components of Genetic variation;
- Heritability and genetic advance
- Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection
- Hybridization techniques and handling of segregating population

- Multiline concept. Concepts of population genetics and Hardy-Weinberg Law

UNIT-III **04 Hours**

- Genetic basis and methods of breeding cross pollinated crops, modes of selection
- Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes
- Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties
- Breeding methods in asexually propagated crops, clonal selection and hybridization
- Maintenance of breeding records and data collection

UNIT-IV **04 Hours**.

- Wide hybridization and pre-breeding
- Polyploidy in relation to plant breeding
- Mutation breeding-methods and uses.
- Breeding for important biotic and abiotic stresses;
- Biotechnological tools-DNA markers and marker assisted selection.

UNIT-V **04Hours**

- Participatory plant breeding;
- Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.
- Study of floral structure of self-pollinated and cross pollinated crops.
- Emasculation and hybridization techniques in self and cross pollinated crops
- Consequences of inbreeding on genetic structure of resulting populations.

UNIT-VI **04Hours**

- Plant Breeder's kit, Study of germplasm of various crops
- Polyploidy in relation to plant breeding
- Mutation breeding-methods and uses.
- Breeding for important biotic and abiotic stresses
- Biotechnological tools-DNA markers and marker assisted selection.

UNIT VII **04 Hours**

- Plant Breeder's kit, Study of germplasm of various crops
- Polyploidy in relation to plant breeding
- Mutation breeding-methods and uses.
- Breeding for important biotic and abiotic stresses
- Study of male sterility system. Handling of segregation populations

UNIT VIII **04 Hours**

- Methods of calculating mean, range, variance, standard deviation, heritability
- Designs used in plant breeding experiments, analysis of Randomized Block Design
- To work out the mode of pollination in a given crop and extent of natural out-crossing
- Prediction of performance of double cross hybrids.

Recommended Books:(LatestEditions)

- Singh BD: Genetics (3rd Edition) Kalyani Publishers
- Singh B D: A Textbook of Plant Breeding, Kalyani Publishers
- Genetics (3rd Edition) Monroe W. Strickberger Prentice Hall of India Private Limited
- Singh B D: Plant Breeding- Principles and Methods,Kalyani Publishers

Reference Books

- Stoskopf N C,Tomes D T and Christie B R: Plant Breeding Theory and Practices Scientific Publishers
- SharmaAK:CropImprovementandMutationBreeding, Scientific Publishers
- SinghCB:GeneticImprovementofFieldCrops, New India Publications
- ChakrabortyS:PlantMolecularGenetics, Scientific Publishers
- DwivediP:PlantTissueCulture, ICAR, New Delhi.
- KumarS:PlantTissueCulture:Theory&Techniques, ICAR, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12

GPB 202.1	2	2	3	-	-	-	-	-	1	-	-	
GPB 202.2	3	1	3	3	-	2	-	2	-	-	3	
GPB 202.3		-	2	3	-	1	2	2	-	-	2	
GPB 202.4	2	3	-	-	-	3	1	1	2	-	1	
GPB 202.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	**ACGP 203**
Course Title	**AGRICULTURAL MICROBIOLOGY**
Category	

LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on agricultural microbiology pertains to soil and plant processes governed by microorganisms

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know the microbial world in relation to agricultural processes
- Appreciate different processes in soil, plant,water governed by microbes
- Learn the role of microbes in soil fertility and crop production
- Understand microbe-mediated Carbon, Nitrogen, Phosphorus and sulphur cycles,
- Appreciate microbe's role as biofertilizers, biopesticides, biofuel production and biodegradation.

CourseContent

UNIT– I **05 Hours**

- Introduction to Microbial world
- Prokaryotic and eukaryotic microbes
- Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth
- Bacterial genetics
- Genetic recombination- transformation

UNIT-II **05 Hours**

- Conjugation and transduction,Plasmids, transposon
- Role of microbes in soil fertility and crop production
- Microbial transformation of Carbon in soil
- Microbial transformation of Nitrogen in soil
- Microbial transformation of Sulphur in soil

UNIT-III **05 Hours**

- Biological nitrogen fixation- symbiotic
- Biological nitrogen fixation-asymbiotic
- Azolla, blue green algae and mycorrhiza
- Rhizosphere and phyllosphere
- Mycorrhiza in micronutrient availability

UNIT-IV **05 Hours**.

- Microbes in human welfare
- Introduction to microbiology laboratory and its equipment.
- Microscope- parts, principles of microscopy, resolving power and numerical aperture
- Methods of sterilization

UNIT-V **05Hours**

- Nutritional media and their preparations
- Enumeration of microbial population in soil- bacteria, fungi, actinomycetes.
- Methods of isolation and purification of microbial cultures
- Isolation of *Rhizobium* from legume root nodule.
- Isolation of *Azotobacter* from soil.
- Isolation of *Azospirillum* from roots.
- Staining and microscopic examination of microbes.

Recommended Books:(LatestEditions)

- Fundamental Agricultural Microbiology K.R. Aneja New Age International Publishers
- Pareek R. P and Pareek N: Agricultural Microbiology, Scientific Publishers
- Rangaswami G and Bhagyaraj D J: Agricultural Microbiology (2nd Edition) B,Prentice Hall of India Learning Pvt. Ltd.
- Dudhe Y: AgriculturalMicrobiology, New Vishal Publications
- Mukherjee N and Ghosh T: Agricultural Microbiology, Kalyani Publishers
- KarwaAS:Handbook of Techniques in Microbiology: ALaboratoryGuidetoMicrobes, ICAR New Delhi

Reference Books

- PareekRP:AgriculturalMicrobiology, Elsevier Publications
- KumarV:LaboratoryManualofMicrobiology, ICAR, New Delhi
- SaxenaJ:LaboratoryManualofMicrobiology,BiochemistryandMolecularBiology, Scientific Publishers
- ReddyBSR:MicrobialDiversity:Exploration&Bioprospecting, ICAR, New Delhi
- ReddySR:MicrobialPhysiology, Scientific Publishers
- Manoharachary C: Mycology and Microbiology: ATextbookforUGandPG, Scientific Publishers.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
ACGP 203.1	2	2	3	-	-	-	-	-	1	-	-	
ACGP 203.2	3	1	3	3	-	2	-	2	-	-	3	
ACGP 203.3		-	2	3	-	1	2	2	-	-	2	
ACGP 203.4		3	2	2	-	3	1	1	2	-	1	
ACGP 203.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	**AEN 204**			
Course Title	**PEST OF CROP AND STORAGE AND THEIR MANAGEMENT**			
Category				
LTP & Credits	L	T	P	Credits

	2		1	3
Total Contact Hours	36			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on protection of insect pests of crops and manage those during storage.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the management practices of insects in crops and the stored items
- Learn the diversity of insect pests in cereals, pulses, fruits, vegetables etc.
- Understand the major achievements and future prospects in the subject
- Know the biology of insect pests in grains as well as in fruits
- Know about the pest management in spices, flower, ornamental plantsetc

CourseContent

UNIT– I **05 Hours**

- Stored grain pestsand their biology
- NSD and their management
- Insect pests of rice their biology and management
- NSD and their management
- Insect pests of wheat, maize, sorghum, ragi, sugarcane, jute, cotton, mesta

UNIT-II **05 Hours**

- Pests of oilseed crops (Ground nut, mustard, castor, sunflower and safflower)
- Pests of pulses and their biology and management
- Pests of Solonaceous, Cruciferous, Cucurbits, bhindi, moringa and amaranths
- Pests of mango and banana, their biology and management
- Pests of citrus, cashew, coconut, coffee, tea, their biology and management

UNIT-III **05 Hours**

- Pests of Grapevine, pomegranate, guava, sapota, ber, apple, tobbaccoo, their biology
- Pests of chilli, betelvine, onion, turmeric, coriander, garlic, curry, leaf, pepper, ginger, their biology
- Pests of ornamental plants and their management.
- Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: Field crops
- Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: Vegetable crops

UNIT-IV **05 Hours**.

- Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: Fruits
- Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: Plantation crops
- Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: Spices and condiments
- Identification of insect pests and Mites associated with stored grain
- Determination of insect infestation by different methods

UNIT-V **05Hours**

- Assessment of losses due to insects
- Calculations on the doses of insecticides
- Fumigation of grain store / godown
- Identification of rodents and rodent control operations in godowns
- Identification of birds and bird control operations in godowns

UNIT-VI **05 Hours**

- Determination of moisture content of grain
- Methods of grain sampling under storage condition
- Visit to nearest FCI godowns.
- Visit to Indian Storage Management and Research Institute, Hapur and Quality

Laboratory, Department of Food., Delhi

- Bio-control methods

Recommended Books:(LatestEditions)

- SinghB:BiologicalandMolecularApproachesinPestManagement, Scientific Publishers
- HerdmanRC:BiologicallyBasedTechnologiesforPestControl, Oxford, IBH Pvt Ltd
- DodiaDA:BotanicalPesticidesforPestManagement
- ReddyPP:InsectMiteandVertebratePestsandTheirManagementinHorticultural Crops, ICAR, New Delhi
- DhawanAK:IntegratedPestManagement, ICAR, New Delhi

Reference Books

- YoudeoweiP:PestandVectorManagementintheTropics, Scientific publishers
- DhawanAK:TheoryandPracticeofIntegratedPestManagement, ICAR, New Delhi
- HassallKA:TheChemistryofPesticidesTheirMetabolism,Modeof,
- ActionandUsesinCropProtection, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
AEN 204.1	2	2	3	-	2	-	-	-	1	-	-	
AEN 204.2	3	1	3	3	2	2	-	2	-	-	3	2
AEN 204.3	1	-	2	3	3	1	2	2	-	2	2	2
AEN 204.4	2		3	-	-	3	1	1	2	-	1	
AEN 204.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	**PPA 205**
Course Title	**DISEASES OF FIELD AND HORTICULTURAL CROPS AND THEIR MANAGEMENT I**
Category	

LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on major diseases of all types of Field and Horticultural crops and their control.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the diseases and their management practices in a wide array of crops
- Learn the diversity of diseases in cereals, pulses, fruits, vegetables etc.
- Understand the major achievements and future prospects in the subject
- Know the symptoms, etiology, disease cycle
- Know management of major diseases of Field and Horticultural crops and their management

CourseContent

UNIT– I **05Hours**

- Symptoms, etiology, disease cycle and management of major diseases of field and horticultural crops
- Field Crop, Rice: blast, brown spot, bacterial blight, sheath blight and false smut
- Field Crop, Maize: leaf spots;
- Field Crop, Groundnut: early and late leaf spots, rust
- Field Crop, Pigeon pea: Wilt and sterility mosaic

UNIT-II **05Hours**

- Field Crop, Black and Green gram: Cercospora leaf spot and yellow mosaic
- Field Crop, Tobacco: Leaf curl and mosaic.
- Horticultural Crops, Guava: wilt and *Pestalotia* blight
- Horticultural Crop, Banana: Panama wilt and Sigatoka
- Cruciferous vegetables: *Alternaria* leaf spot and black rot

UNIT-III **05Hours**

- Brinjal: *Phomopsis* blight and fruit rot and *Sclerotinia* blight, Bacterial Wilt
- Tomato: damping off, wilt, early and late blight and leaf curl
- Okra: Yellow Vein Mosaic virus
- Beans: anthracnose
- Ginger: soft rot

UNIT-IV **05Hours**.

- ***Colocasi****a*: *Phytophthora* blight
- Coconut:*Pestalotia* leaf spot, wilt and bud rot
- Tea: blister blight; Coffee: rust.
- Identification and histopathological studies of selected diseases of field crops
- Identification and histopathological studies of selected diseases of horticultural crops

UNIT-V **05Hours**

- Collection and preservation of plant diseased specimens
- Preparation of Disease herbarium
- Field visit to see the diseases
- Visit to some agricultural institute, research station
- Interaction with expert in the field

Recommended Books:(LatestEditions)

- GuptaSK:ApproachesandTrendsinPlantDiseaseManagement, Scientific Publishers, Jodhpur

- LodhaS:DiseaseManagementinAridLandCrops, ICAR, New Delhi
- ThindTS:DiseaseProblemsinVegetableProduction2ndEd, ICAR, New Delhi
- GuptaSK:DiseasesofVegetableOrnamentalandSpiceCrops, Scientific Publishers

Reference Books

- ThindBS:PhytopathogenicProcaryotesandPlantDiseases,CRC Press, Taylor & Francis Group
- ReddyPP:PlantProtectioninHorticultureVol.1-3, ICAR, New Delhi
- RavichandranN G:AgrochemicalsinPlantDiseasesManagement, Scientific Publishers. India

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
PPA 205.1	2	2	3	-	2	-	-	-	1	-	-	1
PPA 205.2	3	1	3	3	1	2	-	2	-	2	3	1
PPA 205.3		-	2	3	-	1	2	2	-	2	2	2
PPA 205.4	2		3	-	-	3	1	1	2	-	1	2
PPA 205.5	3	2	1	1	-	-	-	-	-	1	2	-

Course Code	**AEC 206**			
Course Title	**AGRICULTURAL FINANCE AND COOPERATION**			
Category				
LTP & Credits	L	T	P	Credits

	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on Agricultural Finance meaning, scope and significance, credit needs and its role in Indian agriculture.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the Agricultural Finance: meaning, scope and significance, credit needs and its role in Indian agriculture
- Learn the Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks
- Understand the higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India.
- Know the Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and IncomeCourseContent
- Know Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture

CourseContent

UNIT– I **05 Hours**

- Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture.
- Agricultural credit: meaning, definition, need, classification
- Credit analysis: 4 R's, and 3C's of credits
- Sources of agricultural finance: institutional and non-institutional sources Commercial banks, social control and nationalization of commercial banks

UNIT-II **05 Hours**

- Micro financing including KCC. Lead bank scheme, Researve Bank of India
- Scale of finance and unit cost
- An introduction to higher financing institutions – RBI, NABARD, ADB, IMF World

Bank

- Insurance and Credit Guarantee Corporation of India
- Cost of credit

UNIT-III **05 Hours**

- Recent development in agricultural credit
- Tomato: damping off, wilt, early and late blight and leaf curl
- .Preparation and analysis of financial statements – Balance Sheet and Income Statement.
- Basic guidelines for preparation of project reports
- Bank norms – SWOT analysis

UNIT-IV **05 Hours**.

- Agricultural Cooperation – Meaning, brief history of cooperative development in India
- Objectives, principles of cooperation
- Significance of cooperatives in Indian agriculture
- Agricultural Cooperation in India- credit, marketing
- Consumer and multi-purpose cooperatives, farmers' service

UNIT-V **05Hours**

- Cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing
- Role of ICA, NCUI, NCDC, NAFED
- Determination of most profitable level of capital use
- Optimum allocation of limited amount of capital among different enterprise.
- Analysis of progress and performance of cooperatives using published data

UNIT VI **05 Hours**

- Estimation of credit requirement of farm business – A case study.

- Analysis of progress and performance of commercial banks and RRBs using published data
- Preparation and analysis of balance sheet – A case study
- Preparation and analysis of income statement – A case study.
- Appraisal of a loan proposal – A case study
- Preparation of Bankable projects for various agricultural products and its value added products.

Recommended Books:(LatestEditions)

- CholeR.R:EntrepreneurshipDevelopmentandCommunicationSkills, Scientific Publishers
- KhanD:EntrepreneurshipinFarming, ICAR, New Delhi,

Reference Books

- FAO Hand Book:FarmBusinessSchool, FAO, Rome
- ObstW:FinancialManagementforAgribusiness, Scientific Publishers
- DiwaseS:IndianAgriculture&AgribusinessManagement,3rdEd. Krishi Resource Management Network, New Delhi
- VermaSB: Rural Marketing, Scientific Publishers. India

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
PPA 206.1	2	2	3	-	-	-	-	-	1	-	-	1
PPA 206.2	3	1	3	3	-	2	-	2	-	-	3	2
PPA 206.3		-	2	3	-	1	2	2	-	-	2	-
PPA 206.4	2		3	-	-	3	1	1	2	-	1	-
PPA 206.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**AEX 207**
Course Title	**COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT**

Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on the techniques to enhance communication skills and develop personality

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the Communication Skills its Meaning, Definition and process of communication. Verbal and non-verbal communication, models and barriers to communication
- Understandthe Extension teaching Methods its meaning, classification, individual and group and mass contact method, media mix strategies
- Enhance Writing Skills, oral presentation skills, individual and group presentations, impromptu presentation, public speaking, group discussion
- Organize seminars and conferences, leader, leadership styles, characteristics of leader and Manager.
- Withstand Stress, Adaptation, Distress and Eustress, Sources of job stress and consequences,

CourseContent

UNIT– I **05Hours**

- Concept of Communication Skills
- Meaning, Definition and process of communication.
- Verbal and non-verbal communication
- Models and barriers to communication
- Extension teaching ‘Methods’

UNIT-II **05Hours**

- Meaning, classification, individual and group and mass contact method, media mix strategies
- Meaning, classification, individual and group and mass contact method, media mix strategies
- Organizing seminars and conferences,
- Leader, leadership styles, characteristics of leader
- Sources of job stress and consequences

UNIT-III **05Hours**

- Group dynamics and team building
- Group formation, group dynamics
- Inter-group relation in organization
- Leam building, nature of team, effectiveness of team.
- Conflict, levels of conflict, intra and inter personal conflict,

UNIT-IV **05Hours**.

- Organizational conflict, conflict resolution
- Objectives, principles of cooperation
- Motivation, sources of motivation and theories of motivation
- Personality: Definition, types, analysis and profiling and development.
- Team building and Leaderdhip

UNIT-V **05Hours**

- Interactive lecture with AV aids for improving listening skills and note taking of students.
- Impact analysis of oral presentation skills by using standard format
- Writing skills: Directed writing precise, Summary, field report etc

- Indexing, footnote and bibliographic procedures etc.
- Analysis of progress and performance of cooperatives using published data
- Reading and comprehension skills:
- Testing of pitch, intonation, pause, fidelity and impact analysis.
- Group discussion, presentations and skill analysis.

Recommended Books:(LatestEditions)

- KadamJR:CommunicationSkillsandPersonalityDevelopment, Scientific Publishers
- OakleyPO:GuidetoExtensionTraining, ICAR, New Delhi

Reference Book

- CholeRR:EntrepreneurshipDevelopmentandCommunication Skills, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
AEX207.1	3	2	3	2	2	-	2	-	1	-	-	2
AEX207.2	2	1	3	3	-	2	-	2	-	-	3	1
AEX207.3		-	2	3	2	1	2	2	-	-	2	1
AEX207.4	2		3	-	-	3	1	1	2	-	1	-
AEX207.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**ACH 208**			
Course Title	**CROP PROTECTION CHEMICALS AND THEIR APPLICATION**			
Category				
LTP & Credits	L	T	P	Credits

	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on chemical plant protectants, their efficacy, toxicity etc.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand crop protecting chemicals: definition, history, classification, toxicity and use pattern of pesticides in plant protection
- Understand plant growth regulators and post-harvest chemicals
- Learn the toxicity of the chemicals
- Understand the right application procedure and doses of the synthetic pesticides
- Learn the danger of contamination due to over use and non-scientific disposal

Course Content

UNIT– I **05 Hours**

- Introduction to crop protecting chemicals
- Definition, history, classification, toxicity and use pattern of Pesticides.
- Other uses of pesticides
- Nomenclature, chemical structure, formulation type and mode of action of some popular pesticides
- Insecticides [Organo-Chlorines (Endosulfan, HCH), Organo-Phosphates

UNIT-II **05 Hours**

- Organo-Phosphates (Chlorpyrifos, Malathion)
- Carbamates (Carbaryl, Carbofuran),
- (Chlorpyrifos, Malathion) and Herbicides (2,4-D, Glyphosate).

- Introduction to the chemistry and use of some common Acaricides, Nematicides,
- Rodenticides, Molluscides

UNIT-III **05 Hours**

- Plant Growth Regulators and Post-Harvest Chemicals
- Important Name Reactions used in Pesticide Chemistry
- Diel's Alder Reaction,
- Aldol Condensation,
- Perkin Reaction,

UNIT-IV **05 Hours**.

- Friedel Crafts' Reaction,
- Grignard Reaction,
- Michaelis-Arbuzov and Perkow Reaction.
- Identification and familiarizations with the basic apparatus and equipment used in pesticide laboratory
- Detection of functional group present in Pesticide Molecule

UNIT-V **05Hours**

- Phenolic OH, Aldehyde,
- Ketone, Carboxylic Acid,
- Primary Aromatic Amine,
- Ester; Identification of different formulation with toxicological pattern;
- Estimation of insecticides (Endosulfan, HCH) by hydrolysable chlorine;
- Estimation of Cu & S present in inorganic fungicides.

Recommended Books(LatestEditions)

- Ohkawa H, Miyagawa H and Lee PW: Pesticide Chemistry: Crop Protection, Public Health, Environmental Safety, Wiley-VCH Verlag GmbH & Co. KGaA

Reference Book

- RathoreH S and NolletL M L: Pesticides, Evaluation of Environmental Pollution, CRCPress.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
ACH208.1	3	2	3	2	-	-	-	-	1	-	-	2
ACH208.2	3	1	3	3	-	2	-	2	-	-	3	-
ACH208.3	2	1	2	3	2	1	2	2	-	-	2	2
ACH208.4	2		3	-	-	3	1	1	2	-	1	-
ACH208.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	**HORT (A) 209**			
Course Title	**PRODUCTION TECHNOLOGY FOR VEGETABLES AND SPICES**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on production technology of vegetable and importance of vegetables and spices in human nutrition and national economy,

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand importance of vegetables and spices in human nutrition and national economy
- Learn about kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices
- Know thetime of sowing, transplanting techniques, planting distance, fertilizer requirements,
- Learn irrigation, weed management, harvesting and yield vegetables and spices,
- Learn physiological disordersof important vegetable and spices

Course Content

UNIT– I **05Hours**

- Importance of vegetables & spices in human nutrition and national economy
- Definition, history, classification, vegetables and spices
- Kitchen gardening technology,
- Brief about origin, area, climate, soil, improved varieties
- Cultivation practi*ces*such as time of sowing, sowing, transplanting techniques,

UNIT-II **05Hours**

- Cultivation practi*ces*such as time of sowing, sowing, transplanting techniques,
- Planting distance, fertilizer requirements, irrigation,
- Weed management, harvesting and yield
- Physiological disorders, of important vegetable and spices

- Plant Growth Regulators and Post-Harvest Chemicals

UNIT-III **05Hours**

- Tomato, Brinjal, Chilli
- Capsicum, Cucumber, Melons
- Gourds, Pumpkin, French bean, Peas
- Cole crops such as Cabbage, Cauliflower, Knol-khol
- Bulb crops such as Onion, Garlic

UNIT-IV **05Hours**

- Root crops such as Carrot, Radish, Beetroot
- Tuber crops such as Potato
- Leafy vegetables such as Amaranth, Palak. Perennial vegetables.
- Root crops such as Carrot, Radish, Beetroot
- Tuber crops such as Potato

UNIT-V **05Hours**

- Identification of vegetables and spice crops and their seeds.
- Perennial vegetables,Leafy vegetables such as Amaranth, Palak.
- Leafy vegetables such as Amaranth, Palak. Perennial vegetables
- Identification of vegetables and spice crops and their seeds.
- Nursery raising. Direct seed sowing and transplanting.
- Study of morphological characters of different vegetables and spices.
- Cultivation of off-season vegetables
- Fertilizers applications.
- Harvesting & preparation for market.
- Economics of vegetables and spices cultivation.

Recommended Books:(LatestEditions)

- SinghSP:AdvancesinHorticultureandForestry(1-9), ICAR, New Delhi
- GuptaSK:DiseaseProblemsinVegetableProduction(2ndEd.), Scientific Publishers
- GuptaSK:DiseasesofVegetableOrnamentalandSpiceCrops, Scientific Publishers

Reference Books

- SudRK:FlowersandVegetablesofIndia, ICAR, New Delhi
- AryaRL:FundamentalsofHorticulture, Scientific Publishers
- NairB:FundamentalsofVegetableCropProduction, Scientific Publishers
- SinghSP:ScientificHorticulture(Vol.2-10), ICAR, New Delhi
- TyagiSK:VegetableCropsatAGlance, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
HORT (A) 209.1	3	2	3	2	2	-	1	-	1	-	-	2
HORT (A) 209.2	3	1	3	3	-	2	-	2	-	-	3	2
HORT (A) 209.3		-	2	3	-	1	2	2	-	-	2	1
HORT (A) 209.4	2		3	-	-	3	1	1	2	-	1	1
HORT (A) 209.5	3	2	1	1	-	-	-	-	-	-	2	-

Course Code	

Course Title	**FARM MACHINERY AND POWER**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on the mechanical power being used in different stages of farm operation viz, planting, harvesting and processing etc

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Get a complete knowledge on motor power used in agricultural operations.
- Know the status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of I. C. engines
- Familiarize with different systems of I.C. engines: Air cleaning, cooling, lubrication,fuel supply and hydraulic control system of a tractor,
- Understand the Power transmission system: clutch, gear box, differential and final drive of a tractor,
- Learn different types of primary and secondary tillage implements: mouldboard plough, disc plough and disc harrow.

Course Content

UNIT– I **05Hour**

- Status of Farm Power in India,
- Sources of Farm Power, I.C. engines, working principles of I. C. engines,
- Comparison of two stroke and four stroke cycle engines Sources of Farm Power, I.C. engines,
- Working principles of I. C. engines, comparison of two stroke and four stroke cycle engines
- To study air cleaning and cooling system of engine,

UNIT– II **05Hour**

- Lubrication,fuel supply and hydraulic control system of a tractor,
- Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor,
- Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement,
- Implement for hill agriculture, implement for intercultural operations,
- Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples,

UNIT III **05Hour**.

- Tractor types, Cost analysis of tractor power and attached implement,
- Familiarization with Primary and Secondary Tillage implement,
- Implement for hill agriculture, implement for intercultural operations,
- Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples,
- Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

UNIT IV **05Hour**

- Study of different components of I.C. engine
- To study air cleaning and cooling system of engine,
- Familiarization with clutch, transmission, differential and final drive of a tractor
- Familiarization with lubrication and fuel supply system of engine
- Familiarization with brake, steering, hydraulic control system of engine

- **UNIT-V** **05Hours**
- Learning of tractor driving
- Familiarization with operation of power tiller
- Implements for hill agriculture
- Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow.

- Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter
- Familiarization with different types of sprayers and dusters
- Familiarization with different inter-cultivation equipment
- Familiarization with harvesting and threshing machinery.

Recommended Books:(LatestEditions)

- BosonES:Theory,ConstructionandCalculationAgriculturalMachines(Vol.1),Academic Press, NY, USA
- Smith:TestingandEvaluationofAgriculturalMachineryandEquipment, FAO Agricultural Services Bulletin, FAO, Rome

Reference Books

- FAO Bulletin:Agricultural Engineering in Development:Guidelines for MechanizationSystems and MachineryRehabilitationProgrammes, FAO, Rome
- BallsRC:HorticulturalEngineeringTechnologyFieldMachinery, ICAR, New Delhi
- USDI:CanalSystemsAutomationManual, Wsahington DC
- GhoshRK:PracticalAgriculturalEngineering, Naya Prakash, Kolkata

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AEG(A) 210.1	3	2	3	2	-	-	-	-	1	-	-	1
AEG(A) 210.2	3	1	3	3	-	2	-	2	-	2	3	2
AEG(A) 210.3	3	-	2	3	-	1	2	2	-	2	2	1
AEG(A) 210.4	2		3	-	-	3	1	1	2	-	1	2
AEG(A) 210.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	**HVA 211**
Course Title	**HUMAN VALUES AND ETHICS**

Category				
LTP & Credits	L	T	P	Credits
	1		0	1
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on Human Values and Ehics an introduction, goal and mission in life

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the role of human value and ethics in life
- Understand the goal and mission in life
- Realize the vision and mission in life
- Practice self-exploration,self-awareness,self-satisfaction
- Understand the meaning of spirituality

Course Content

UNIT– I **08Hour**

- Values and Ethics in life
- An Introduction to Goal and Mission of Life
- Vision of Life
- Principles and Philosophy
- Self-Exploration.

UNIT– II **08Hour**

- Self-Awareness.
- Self-Satisfaction,
- Decision making
- Motivation
- Sensitivity and success

UNIT III **08 Hour**.

- A selfless service
- Case study of ethical life
- Positive spirit, Spirituality quotient
- Body, mind and soul
- Attachment and detachment

Recommended Books:(LatestEditions)

- Chakraborty D: Human Values and Ethics, Himalaya Publishing House
- Naagarajan RS: A Text book on Professional Ethics and Human Values, New Age International publishers

Reference Books

- ChakrabortyD:A Text Book on Human Values and Ethics, New Delhi Publishers

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
HVE 211.1	3	2	3	2	-	-	-	-	1	-	-	2
HVE 211.2	3	1	3	3	-	2	-	2	-	-	3	1
HVE 211.3	3	-	2	3	-	1	2	2	-	-	2	-
HVE 211.4	2		3	-	-	3	1	1	2	-	1	-
HVE 211.5	3	2	1	1	-	-	-	-	-	-	2	

SEMESTER IV

Course Code	**AGR 251**			
Course Title	**CROP PRODUCTION TECHNOLOGY III (RABI CROPS)**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on technology of crop productivity and production with special reference to winter crops

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know the origin, geographic distribution, economic importance, soil and climatic requirement of Rabi crops
- Learn about production technology of tuber crop: Potato
- Learn about the production technology of Oilseed crops: Sesame, Groundnut, Soybean, Safflower
- Understand the cultural practices viz, time, tillage, fertilizer, crop protectant etc of Rabi crops
- Understand the crop management practices of Forage crops: Maize, Sorghum, Oat, Berseem, Lucerne, Cowpea, Ricebean, Napier and Cluster bean

CourseContent

UNIT– I **05Hours**

- Origin, geographic distribution, economic importance of the *Rabi*crops
- Soil and climatic requirement, varieties, cultural practices and yield of *Rabi*crops
- Advance crop management practices
- Tuber crop: Potato
- Oilseed crops: Sesame, Groundnut, Soybean, Safflower

UNIT-II **05 Hours**

- Forage crops: Maize, Sorghum, Oat, Berseem, Lucerne, Cowpea, Ricebean, Napier and Cluster bean
- Field preparation and sowing of *Rabi* cereals and pulse crops including inter / mixed cropping
- Field preparation, sowing of *rabi*/ summer tuber, oilseed and forage crops
- Calculations on seed rate and fertilizers
- Top dressing, and foliar feeding of nutrients

UNIT-III **05 Hours**

- Identification of weeds and their control measures
- Important intercultural operations and water management in *Rabi* rops
- Morphological and yield attributing characteristics
- Estimation of yield, harvesting, threshing, winnowing and storage of *Rabi* field crops
- Harvest Index

UNIT-IV **05Hours**.

- Cost of cultivation; Crop distribution in West Bengal and its ecological regions
- Study of crop varieties and important agronomic experiments at experimental farms
- Visit to research stations for related *Rabi* crops and multiple cropping.
- Post-harvest management of the grains
- Use of pesticides rodenticides

UNIT-V **05 Hours**

- Study of crop varieties and important agronomic experiments at experimental farms
- Visit to research stations for related *rabi* / summer crops and multiple cropping.
- Estimation of profit per ha based on cost of cultivation and total income
- Sharing technology with farmers
- Prescribing most profitable cropping system

Recommended Books:(LatestEditions)

- Khare D and Bhale BS:SeedTechnology.2nded., Scientific Publishers
- DasN:IntroductiontoCropsofIndia.2nd Edition. Kalyani Publishers
- Jat,M.L:DrylandTechnology2ndEd., Scientific publishers
- Khare D : Farm Mechanization for Production ofPulses, Scientific Publishers
- GhoshP:ResourceConservationTechnologyinPulses, Scientific Publishers

Reference Books

- SharmaAR:ResourceConservingTechniquesinCropProduction, New Age Publishers
- FAO:TheUseofSalineWatersforCropProduction, FAO, Rome
- DasNR:WheatCropManagement, Scientific Publishers
- DasNR:GlossaryofIndianCrops, ICAR, New Delhi
- KhareD:FarmMechanizationforProduction, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AGR 251.1	2	2	3	-	-	-	-	-	1	-	-	1
AGR 251.2	3	1	3	3	2	2	-	2	-	-	3	2
AGR 251.3	1	-	2	3	2	1	2	2	-	-	2	-
AGR 251.4	-	3	2	2	-	3	1	1	2	-	1	--
AGR 251.5	3	2	1	1	1	-	-	-	-	-	2	-

Course Code	**AMP 252**
Course Title	**AGRO-METEOROLOGY AND CLIMATE CHANGE**
Category	

LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on agro-meteorology and its role on agriculture vis-à-vis prediction of climate change

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understandmeaning and scope of agricultural meteorology and its implication in agriculture
- Understand Earth atmosphere—its composition, extent and structure; Atmospheric weather variables
- Understand the nature and properties of solar radiation, solar constant, short wave, long wave and thermal radiation, net radiation, albedo
- Understand precipitation—process of precipitation, types of precipitation such as rain, snow, sleet and hail, cloud classification, artificial rainmaking
- Learn weather forecasting—types of weather forecast and their uses, Climate change, climatic variability, global warming, causes of climate change and its impact on agriculture.

CourseContent

UNIT– I **05Hours**

- Meaning and scope of agricultural meteorology
- Earth atmosphere—its composition, extent and structure
- Atmospheric weather variables; Atmospheric Pressure, its variation with height
- Wind—types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze
- Nature and properties of solar radiation, solar constant

UNIT-II **05 Hours**

- Short wave, long wave and thermal radiation, net radiation, albedo
- Atmospheric temperature, temperature inversion, lapse rate, daily temperature

- seasonal variations of temperature, vertical profile of temperature
- Atmospheric humidity, concept of saturation
- Vapour pressure, process of condensation, formation of dew, fog, mist, frost, cloud

UNIT-III **05 Hours**

- Precipitation—process of precipitation, types of precipitation such as rain, snow, sleet and hail, cloud classification
- Artificial rainmaking
- Monsoon- its importance in Indian agriculture
- Weather hazards—Droughts, floods, frost, tropical cyclones
- Extreme weather conditions such as heat wave and cold wave.

UNIT-IV **05 Hours**.

- Agriculture and weather relations
- Climatic normal for rice, wheat, mustard, potato, jute and gram crops and major horticultural crops
- Weather forecasting—types of weather forecast and their uses
- Climate change, climatic variability, global warming,
- Causes of climate change and its impact on agriculture.

UNIT-V **05 Hours**

- Visit to Agro-meteorological Observatory--Site selection, exposure of instruments and weather data recording. measurement of albedo and sunshine duration
- Computation of radiation intensity using bright sunshine hour data. measurement of maximum and minimum air temperature—its tabulation, trend and variation analysis
- Measurement of soil temperature.Determination of vapourpressure, relative humidity and dew point temperature.
- Measurement of wind speed and wind direction. Preparation of wind rose.Measurement, tabulation and analysis of rain.
- Measurement of open pan evaporation. computations of evapotranspiration

Recommended Books:(LatestEditions)

- FAO:Climate-SmartAgricultureSourceBook, FAO, Rome
- RaoG P:ClimateChangeAdaptationStrategiesinAgricultureandAlliedSectors, Scientific Publications
- SundaresanJ:ClimateChangeandEnvironment, Scientific Publications
- MohantyM:CropGrowthSimulationModellingandClimateChange., ICAR, New Delhi

Reference Books

- NiggliURS:OrganicAgricultureandClimateChangeMitigation, FiBL, Geneva.
- MoteBM:Principles of Agricultural Meteorology, Scientific Publishers
- PatelAN:RemoteSensing:PrinciplesandApplication2ndEd., Scientific Publishers
- GaurM:RemoteSensingforNaturalResourcesManagement&Monitoring , Scientific Publishers
- ChouhanTS:CombatingDesertificationLandDegradationandClimateChange,ManagementofDryLands, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AMP 252.1	2	2	3	-	3	-	2	-	1	2	-	1
AMP 252.2	3	1	3	3	-	2	-	2	-	-	3	1
AMP 252.3	-	-	2	3	-	1	2	2	-	2	2	-
AMP 252.4	1	3	2	2	-	3	1	1	2	-	1	-
AMP 252.5	3	2	1	1	-	-	-	-	-	-	2	2

Course Code	**SST 253**
Course Title	**PRINCIPLES OF SEED TECHNOLOGY**
Category	

LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on importance of good quality seeds and its production for higher crop productivity.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the necessityofseed and its importance, seed structure and development
- Learn the technology for maintenance of genetic purity during seed production
- Learn the concept of Foundation and Certified seed production
- Understand seed marketing: structure and organization, sales generation activities, promotional media
- Factors affecting seed marketing, role of WTO and OECD in seed marketing.

CourseContent

UNIT– I **06 Hours**

- Definition of seed and its importance
- Seed structure and development, role of seed
- Type of seed(Orthodox and Recalcitrant)
- Deterioration causes of crop varieties and their control
- Maintenance of genetic purity during seed production

UNIT-II **06 Hours**

- Seed quality: Definition, Characters of good quality seed, different classes of seed
- Basic principles of seed production, Foundation and Certified seed production
- Seed certification: Objectives, Agencies
- Phases of certification, procedure for seed certification, field inspection

- Seed control order, 1983

UNIT-III **06 Hours**

- Varietal identification through Grow Out Test and Electrophoresis
- Molecular and Biochemical test
- Detection of genetically modified crops,
- Transgene contamination in non-GM crops,
- GM crops and organic seed production.

UNIT-IV

06Hours.

- Seed drying, processing and their steps, seed testing for quality assessment
- Seed treatment, its importance, method of application and seed packing
- Seed storage; general principles, stages and factors affecting seed longevity during storage
- Seed marketing: structure and organization, sales generation activities, promotional media
- Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

UNIT-V **06 Hours**

- Seed production in major cereals: Rice, Maize and Sorghum
- Seed production in major pulses: Mung, Black gram, Green gram, Pea,Seed production in major oilseeds: Rapeseed-Mustard.
- Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test.
- Genetic purity test: Grow out test and electrophoresis.
- Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Recommended Books:(LatestEditions)

- Khare D:SeedTechnology,2ndEd., Scientific Publishers
- BasraAS:HandbookofSeedScienceandTechnology, ICAR, New Delhi
- MackayD.B:SeedTechnologyintheTropics, Scientific Publishers, India

Reference Books

- Vanangamudi K:WeedSeedBiology, Scientific Publishers
- KhareD: Principles of Seed Technology(ConciseEdition), Scientific Publishers, Jodhpur
- SagwalSS:HowtoRaiseandManage, ICAR, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
SST 253.1	2	3	3	-	3	-	2	-	1	-	2	2
SST 253.2	3	1	3	3	2	2	-	2	-	-	3	-
SST 253.3	3	-	2	3	2	1	2	2	-	-	2	1
SST 253.4	2	3	2	2	-	3	1	1	2	-	1	-
SST 253.5	1	2	1	1	-	-	-	-	-	-	2	2

Course Code	**GPB 254**
Course Title	**CROP IMPROVEMENT I (*RABI CROPS*)**
Category	

LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge followingbreeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield with high adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional).

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know the Centres of origin, distribution of species, wild relatives in different cereals, pulses; oilseeds, fodder crops and cash crops,vegetable and horticultural crops
- Understand Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters
- Understand the major breeding objectives and procedures including conventional and modern innovative approaches
- Know the development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
- Learn Hybrid seed production technology of *Rabi* crops,

CourseContent

UNIT– I **05 Hours**

- Centres of origin, distribution of species
- Wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops
- Vegetable and horticultural crops
- Plant genetic resources, its utilization and conservation
- Maintenance of genetic purity during seed production

UNIT-II **05 Hours**

- Study of genetics of qualitative and quantitative characters

- Major breeding objectives and procedures
- Conventional and modern innovative approaches.
- Development of hybrids and varieties for higher yield, adoptability
- Hybrid varieties for stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)

UNIT-III **05 Hours**

- Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future.
- Floral biology, emasculation and hybridization techniques in different crop species
- Wheat, Oat, Barley,
- Chickpea, Lentil, Field pea, Rajma, Horse gram,
- Rapeseed Mustard, Sunflower, Safflower,

UNIT-IV

05 Hours.

- Potato, Berseem. Sugarcane, Tomato, Chilli, Onion
- Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods
- GM crops and organic seed production.
- Study of field techniques for seed production
- Hybrid seeds production in *Rabi* crops;

UNIT-V **05 Hours**

- Estimation of heterosis,
- Inbreeding depression and heritability
- Layout of field experiments;
- Study of quality characters, study of donor parents for different characters
- Visit to seed production plots;

Recommended Books:(LatestEditions)

- KhareD.: Principles of Seed Technology(ConciseEdition), Scientific Publishers, Jodhpur
- SagwalSS:HowtoRaiseandManage, ICAR, New Delhi

Reference Books

- StoskopfNC:Plantbreeding:theoryandPractice, CRC Press
- SinghB.D:MolecularPlantBreeding, Kalyani Publications
- VanangamudiK:WeedSeedBiology, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
GPB 254.1	2	3	3	-	-	-	-	-	1	-	-	2
GPB 254.1	3	1	3	3	2	2	-	2	-	-	3	1
GPB 254.1	3	-	2	3	2	1	2	2	-	-	2	-
GPB 254.1		3	2	2	-	3	1	1	2	-	1	-
GPB 254.1	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**ACSS 255**
Course Title	**MANURES, FERTLIZERS AND SOIL FERTILITY**

	MANAGEMENT			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	35			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on production and use of bulky organic manure and synthetic chemical fertilizers and their uses in maintaining soil fertility and crop productivity.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know the production techniques of organicmanures and green manure and their nutrient composition.
- Learn properties and methods of preparation of bulky and concentrated organic manures andgreen manure
- Understand role of secondary and micronutrient containing fertlizers in soil fertility management.
- Understand the chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients.
- Know the concept of integrated nutrient management (INM) using organic manure and inorganic fertilizers for a higher nutrient use efficiency

CourseContent

UNIT– I **07Hours**

- Introduction and importance of organic manures
- Properties and methods of preparation of bulky and concentrated manure
- Chemical fertilizers: classification, composition and properties
- Nitrogenous, phosphatic, potassic fertilizers, secondary and micronutrient fertilizers
- Complex fertilizers and nano fertilizers

UNIT-II **07 Hours**

- Soil amendments, Fertilizer Storage, Fertilizer Control Order
- Criteria of essentiality of nutrient elements
- Role, deficiency and toxicity symptoms of essential plant nutrients
- Mechanisms of nutrient transport to plants
- Factors affecting nutrient availability to plants

- **UNIT-III** **07 Hours**

- Chemistry of soil nitrogen, phosphorus, potassium.
- Chemistry of calcium, magnesium, sulphur and micronutrients
- Soil fertility evaluation, Soil testing
- Critical levels of different nutrients in soil
- Forms of nutrients in soil, plant analysis

UNIT-IV

07Hours.

- Rapid plant tissue tests.
- Methods of fertilizer recommendations to crops
- Factor influencing nutrient use efficiency (NUE)
- Methods of application under rainfed and irrigated conditions.
- Nitrification inhibitors

UNIT-V **07 Hours**

- Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry.
- Estimation of available N, P and K in soils.
- Estimation of available Ca, Mn and S in soils.
- Estimation of available micronutrients in soils.
- Estimation of N, P, K and S in plants.

Recommended Books:(LatestEditions)

- KannaiyanS:BiofertilizerTechnology, Scientific Publishers
- FAOBulletin:FertilizersandtheirUse4thEd., FAO, Rome
- PiperCS: SoilandPlantAnalysis, ACS Publications
- RyanJ:SoilandPlantAnalysisLaboratoryManual, Scientific Publishers

Reference Books

- GillWR:SoilDynamicsinTillageandTraction, Scientific Publishers
- FAO Bulletin:FertilizerandPlantNutritionGuide, FAO, Rome
- IFDC:FertilizerManual, USDA, Washington, DC
- FAO Mannual:ManualonFertilizerDistribution, FAO, Rome
- Bockman:AgricultureandFertilizer, CABI Publishing

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
ACSS 255.1	2	3	3	-	2	-	-	-	1	-	-	1
ACSS 255.2	3	1	3	3	2	2	-	2	-	-	3	-
ACSS 255.3	3	-	2	3	2	1	2	2	-	-	2	-
ACSS 255.4		3	2	2	-	3	1	1	2	-	1	2
ACSS 255.5	1	2	1	1	-	-	-	-	-	-	2	1

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Course Code	**PPA 256**
Course Title	**DISEASE OF FIELD AND HORTICULTURAL CROPS AND**

	THEIR MANAGEMENT			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	32			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on the diseases of major field and horticultural crops and their management.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know the diseases of major crops viz.wheat, sugarcane, mustard, lentil, gram and pea
- Learn the disease like rusts, loose smut and*Alternaria* blight of wheat, red rot and ratoon stunting of sugarcane,
- Know the causal organisms like *Alternaria* blight and *Rhizopus* head rotof sunflower,*Alternaria* blight, white rustand downy mildew of mustard;
- Understand wilt and *Ascochyta* blight of gram, rust,*Stemphylium* blight and wiltof lentil and powdery mildew and rust of pea.
- Learn the diseases of major horticultural crops and their managemnt

CourseContent

UNIT– I **08Hours**

- Wheat: rusts, loose smut and*Alternaria* blight
- Sugarcane: red rot andratoon stunting
- Sunflower: *Alternaria* blight and *Rhizopus* head rot
- Mustard: *Alternaria* blight, white rustand downy mildew
- Gram: wilt and *Ascochyta* blight

UNIT-II **08 Hours**

- Lentil: rust, *Stemphylium* blight and wilt
- Pea: powdery mildew and rust.
- Horticultural crops and their diseases

- Mango: anthracnose, malformation and powdery mildew
- Citrus: canker: Grape vine mildew, powdery mildew and anthracnose

UNIT-III **08Hours**

- Potato: early and late blight, leaf roll, mosaicandscab
- Cucurbits: downy mildew, powdery mildew and cucumber mosaic
- Onion and garlic: purple blotch
- Chillies: anthracnose and fruit rot and leaf curl
- Turmeric: *Taphrina* leaf spot

UNIT-IV **08Hours**

- Coriander: stem gall
- Rose: dieback and black leaf spot.
- Methods of fertilizer recommendations to crops
- Identification and histopathological studies of selected diseases of field and horticultural crops
- Field visit for diagnosis of field problems.
- Collection and preservation of plant diseased specimens for herbarium.

Recommended Books:(LatestEditions)

- GuptaSK:ApproachesandTrendsinPlantDiseaseManagement, Scientific Publishers
- LodhaS:DiseaseManagementinAridLandCrops, Scientific Publishers
- ThindTS:DiseaseProblemsinVegetableProduction2ndEd, ICAR, New Delhi

Reference Books

- GuptaSK:DiseasesofVegetableOrnamentalandSpiceCrops, Scientific Publishers
- ThindBS:PhytopathogenicProcaryotesandPlantDiseases, CRC Press

- ReddyPP:PlantProtectioninHorticultureVol.1-3, ICAR, New Delhi
- RavichandranN G:AgrochemicalsinPlantDiseasesManagement, Scientific Publishers, India

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
PPA 256.1	2	3	3	-	-	-	-	-	1	-	-	-
PPA 256.2	1	3	3	3	2	2	-	2	-	3	3	-
PPA 256.2	3	-	1	3	2	1	2	2	-	2	2	2
PPA 256.3	2	3	2	2	2	3	1	1	2	-	1	1
PPA 256.4	1	2	1	1	-	-	-	-	-	-	2	1

Course Code	**AEC 257**
Course Title	**AGRICULTURAL MARKETING, TRADE AND PRICES**

Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	36			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on Agricultural Marketing, Concepts and definitions of market,agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural market

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept and definitions of market,agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural market.
- Know themarketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies
- Visualize Marketing process-concentration, dispersion and equalization, exchange functions – buying and selling, physical functions – storage, transport and processing,facilitating functions – packaging, branding, grading, quality control and labelling
- Learn the types and importance of agencies involved in agricultural marketing, meaning and definition of marketing channel, number of channel levels; marketing channels for different farm products
- Acquaint with the present status and prospects of international trade in agri-commodities; GATT and WTO, Agreement on Agriculture (AoA) and its implications on Indian agriculture, Intellectual Property Right (IPR)

CourseContent

UNIT– I **06Hours**

- Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure
- Marketing mix and market segmentation
- Classification and characteristics of agricultural markets

- Demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products,
- Producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities

UNIT-II **06 Hours**

- Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies
- Nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus
- Factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC
- Characteristics of PLC, strategies in different stages of PLC
- pricing and promotion strategiespricing considerations and approaches – cost based and competition-based pricing

UNIT-III **06 Hours**

- Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits;
- Marketing process and functions: Marketing process-concentration, dispersion and equalization;
- Exchange functions – buying and selling;
- Physical functions – storage, transport and processing;
- Facilitating functions – packaging, branding, grading, quality control and labeling (Agmark);

UNIT-IV

06Hours.

- Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing
- Meaning and definition of marketing channel; number of channel levels
- Marketing channels for different farm products
- Integration, efficiency, costs and price spread: Meaning, definition and types of market integration
- Marketing efficiency; marketing costs, margins and price spread; factors affecting

UNIT-V **06 Hours**

- Cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs;
- Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India
- Risk in marketing: Types of risk in marketing; speculation and hedging; an overview of futures trading, Agricultural prices and policy,Meaning and functions of price, administered prices,need for agricultural price policy
- Trade: Concept of International Trade and its need, theories of absolute and comparative advantage.
- Present status and prospects of international trade in agri-commodities; GATT and WTO, Agreement on Agriculture (AoA) and its implications on Indian agriculture: Intellectual Property Right (IPR.)

UNIT VI **06Hours**

- Plotting and study of demand and supply curves and calculation of elasticities**;** Study of relationship between market arrivals and prices of some selected commodities, Computation of marketable and marketed surplus of important commodities
- Study of price behaviour over time for some selected commodities; Construction of index numbers

- Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity,
- Collection of data regarding marketing costs, margins and price spread and presentation of report in the class
- Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade

Recommended Books:(LatestEditions)

- VermaS:AgriculturalMarketing, Scientific Publishers.
- DiwaseS:IndianAgriculture&AgribusinessManagement,3rdEd. Scientific Publishers

Reference Books

- VermaSB:RuralMarketing, Scientific Publishers
- FAO Bulletin:HorticulturalMarketing:AResourceTrainingManualforExtensionOfficer, FAO, Rome

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AEC 257.1	2	3	3	-	-	-	-	-	1	-	-	2
AEC 257.2	3	1	3	3	-	2	-	2	-	-	3	-
AEC 257.3	3	-	2	3	-	1	2	2	-	-	2	1
AEC 257. 4		3	2	2	-	3	1	1	2	-	1	1
AEC 257.5	1	2	1	1	-	-	-	-	-	-	2	1

Course Code	**AST 258**			
Course Title	**ELEMENTARY STATISTICS**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	35			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on Agricultural Statistics,concepts and use in agricultural research and education.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept of the subject and its implication on representation of data, analysis and presentation
- Know Measures of central tendency and dispersion.Definition of Probability, Addition and Multiplication theorem (with proof).
- Interpretate Simple problems on probability. Binomial and Poisson Distribution. Normal Distribution.
- Know definition of correlation, Scatter diagram, Karl Pearson's coefficient of correlation.Linear regression equation
- Understand Selection of random sample using simple random sampling wit and without replacement.

CourseContent

UNIT– I **07Hours**

- Introduction to Statistics and its applications.
- Graphical representation of data,
- Frequency distribution.Measures of central tendency and dispersion
- Definition of Probability, Addition and Multiplication theorem (with proof).
- Normal Distribution.Definition of correlation

UNIT-II **07 Hours**

- Definition of Correlation
- Scatter diagram, Karl Pearson's coefficient of correlation
- Simple problems on probability.
- Binomial and Poisson Distribution
- Linear regression equation.

UNIT-III **07 Hours**

- Selection of random sample using simple random sampling with and without replacement
- Introduction to Test of Significance
- Chi-square test for goodness of fit and independence of attributes in contingency table
- Analysis of variance, one way and two way classification data analysis.
- Uniformity trial and fertility contour map.
- Principles of experimental designs, analysis of field data by three basic designs, viz., CRD, RBD and LSD.

UNIT-IV

07Hours.

- Formation of Frequency tables.
- Graphical presentation of data.
- Measures of central tendency and dispersion (Ungrouped and grouped data).
- Measures of Skewness and Kurtosis.
- Simple correlation and regression analysis

UNIT-V **07 Hours**

Practical

- Selection of random sample using simple random sampling
- Test of Significance

- F and Chi Square test for goodness of fit and independence of attributes, in contingency table
- One way and two way classification data analysis
- Lay out and analysis of field data by three basic Designs viz. CRD, RBD and LSD.

Recommended Books:(LatestEditions)

- Rangaswamy R :A Textbook of Agricultural Statistics (3 rd Edition New Age International Publishers
- Dhamu K P :Fundamentals of Agricultural Statistics Scientific Publishers
- Rout R K andDasLK: A Textbook of Basic Agricultural Statistics, Kalyani Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AST 258.1	2	3	3	-	2	-	-	-	1	-	-	-
AST 258.2	3	1	3	3	-	2	-	2	-	3	3	-
AST 258.3	3	-	2	3	2	1	2	2	-	3	2	2
AST 258. 4		3	2	2	-	3	1	1	2	-	1	2
AST 258.5	1	2	1	1	-	-	-	-	-	-	2	2

Course Code	**HORT (A) 259**			
Course Title	**PRODUCTION TECHNOLOGY OF FRUIT AND PLANTATION CROPS**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on cultivation and production technology of fruit and plantation crops

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the importance and scope of fruit and plantation crop industry in India
- Know the measures of Root-stock production
- Understand the production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond and; minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut etc
- Know seed propagation, scarification and stratification of seeds.
- Learn propagation methods for fruit and plantation crops

CourseContent

UNIT– I **08Hours**

- Importance and scope of fruit and plantation crop industry in India
- Importance of rootstocks
- Production technologies for the cultivation of major fruits:mango, banana, citrus, grape
- Production technologies for the cultivation of major fruits: guava, litchi, papaya, sapota
- Production technologies for the cultivation of major fruits: apple, pear, peach, walnut

UNIT-II **08 Hours**

- Production technologies for the cultivation of minor fruits: Date, ber , pine apple
- Production technologies for the cultivation of minor fruits: Pomgranate , Jackfruit and Strawberry

- Production technologies for the cultivation of plantation cropcoconut, arecanut, cashew, tea, coffee and rubber.
- Seed propagation.Scarification and stratification of seeds
- Propagation methods for fruit and plantation crops.

UNIT-III **08 Hours**

- .Propagation methods for fruit and plantation crops
- Description and identification of fruit
- Preparation of plant bio regulators and their uses
- Important pests, diseases and physiological disorders of above fruit and plantation crops.
- Visit to commercial orchards.

Recommended Books:(LatestEditions)

- ChandraA.:AridFruitResearch, ICAR, New Delhi
- FAO Hand Book:FruitandVegetableProcessing, FAO, Rome
- FAO Bulletin:GuidelinesforSmall-ScaleFruitandVegetableProcessing, FAO, Rome.

Reference Book

- SinghSP:ProductionTechnologyofFruitCropsinWasteland, Scientific Publishers
- SinghSP:ScientificHorticulture(Vol.2-10), ICAR, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
HORT (A) 259.1	2	3	3	-	2	-	-	-	1	-	-	2
HORT (A) 259.2	3	1	3	3	2	2	-	2	-	-	3	-
HORT (A) 259.3	3	-	2	3	-	1	2	2	-	-	2	1
HORT (A) 259.4		3	2	2	-	3	1	1	2	-	1	1
HORT (A) 259.5	1	2	1	1	-	-	-	-	-	-	2	-

ELECTIVE COURSES

Course Code	**EC 260**			
Course Title	**HILL, DRYLAND AND COASTAL AGRICULTURE**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on cultivation under abiotic stress condition viz. in hilly, dryland and coastal areas.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the growing crops under stressed soil
- Know the technology of terrace and jhum cultivation and upland and salt affected soils
- Understand the production technologies for the cultivation of non-conventional crops
- Learn the technology of rice-fish cultivation in coastal soils
- Can pick up the suitable cropping system under such agro-climatic conditions

CourseContent

UNIT– I **05Hours**

- Concept of hill and dryland culture, distribution in West Bengal
- Terrace cultivation, *jhum* cultivation, traditional farming
- Cropping system, agronomic management including irrigation
- Soil and water conservation methods
- Concept of dryland agriculture, distribution in West Bengal

UNIT-II **05 Hours**

- Soil and climate, moisture stress and drought
- Cropping system, agronomic management including choice of crops / varieties
- Cropping system, agronomic management including choice of crops / varieties
- Moisture conservation, irrigation scheduling, use of indicator plants
- Anti-transpirants; drought avoidance / mitigation practices

UNIT-III **05 Hours**

- Contingent crop planning
- Concept of coastal agriculture, distribution in West Bengal
- Soil and tidal water management
- Cropping system, agronomic management including choice of crops / varieties, irrigation and drainage;
- Agronomic management

UNIT IV **05 Hours**

- Agronomic management
- Sowing and management of rainfed*rabi*crops including use of mulches and anti-transpirant
- Calculation on drought indices and water use efficiency
- Making contour bunds against slopes
- Calculation on scheduling of irrigation for different crops

UNIT V **05 Hours**

- Determination of quality of irrigation water
- Preparation of contingent crop planning schedule
- For early, mid-season and terminal droughts in dryland areas
- Storm-affected areas of coastal region
- Visit to local rice-*cum*-fish culture farm

UNIT VI **05 Hours**

- Sowing and management of rainfed*rabi*crops including use of mulches and anti-transpirants
- Calculation on drought indices and water use efficiency; Making contour bunds against slopes
- Calculation on scheduling of irrigation for different crops
- Selection of quality seeds suitable for adverse conditions
- Multiple/ Relay cropping system

Recommended Books:(LatestEditions)

- Singh R P: Sustainable Development of Agriculture in India, Scientific Publishers
- Subba Reddy S and Reddy YVR: Dryland Agriculture, Agrotech Publishing Company

Reference Book

- Chandrasekaran B,Annadurai K and Samasundaram E:Text Book of Agronomy, Newage International Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 260.1	2	3	3	-	-	-	-	-	1	-	-	2
EC 260.2	3	1	3	3	-	2	-	2	-	-	3	-
EC 260.3	3	-	2	3	-	1	2	2	-	-	2	-
EC 260.4		3	2	2	-	3	1	1	2	-	1	-
EC 260.5	1	2	1	1	-	-	-	-	-	-	2	2

Course Code	EC 261

Course Title	PRODUCTION AND USE OF BIOFERTILIZERS			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on introduction, status and scope. structure and characteristic features of bacterial biofertilizersand their usage.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand what are Bio-fertlizers, the use and efficacy
- Know the strains Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia.
- Understand Cynobacterialbiofertilizers Anabaena, Nostoc, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza
- Learn the production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers.
- Abide by Fertilizer control order (FCO) specifications and quality control of biofertilizers

CourseContent

UNIT– I **10Hours**

- Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers.
- Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium and Frankia
- Cynobacterial biofertilizers- Anabaena, Nostoc, Hapalosiphon and fungal biofertilizer.
- AM mycorrhiza and ectomycorhiza.
- Nitrogen fixation -Free living and symbiotic nitrogen fixation

UNIT-II **10Hours**

- Soil and climate, moisture stress and drought
- Mechanism of phosphate solubilization and phosphate mobilization and K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers.
- FCO specifications and quality control of biofertilizers.
- Application technology for seeds, seedlings, tubers, sets etc.
- Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

PRACTICAL

UNIT-III **10 Hours**

- Contingent crop planning
- Isolation and purification of *Azospirillum* ,*Azotobacter*,
- *Rhizobium*, P-solubilizers and cyanobacteria.
- Mass multiplication and inoculums production of biofertilizers.
- Isolation of AM fungi -Wet sieving method and sucrose gradient method.
- Mass production of AM inoculants.

Recommended Books:(LatestEditions)

- KannaiyanS.:BiofertilizerTechnology, Scientific Publishers
- KoulO:BiopesticidesinSustainableAgricultureProgressandPotential, Scientific Publishers.
- DodiaDA.:BotanicalPesticidesforPestManagement, Scientific Publishers.

Reference Books

- SinghB:BiologicalandMolecularApproachesinPestManagement, Scientific Publishers
- HerdmanR.C:BiologicallyBasedTechnologiesforPestControl, Scientific Publishers, Jodhpur, India
- Singh R P: Sustainable Development of Agriculture in India, Scientific Publishers
- Subba Reddy S and Reddy YVR: Dryland Agriculture, Agrotech Publishing Company
- Chandrasekaran B,Annadurai K and Samasundaram E:Text Book of Agronomy, Newage International Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
EC 261.1	3	2	2	2	-	2	-	-	1	-	-	1
EC 261.2	2	1	3	3	-	2	-	2	-	-	3	2
EC 261.3	3	-	2	3	2	1	2	2	-	-	2	1
EC 261.4	1	3	2	2	-	3	1	1	2	-	1	-
EC 261.5	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**EC 262**

Course Title	CHEMISTRY OF PESTICIDES			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on agrochemicals, their type and role in agriculture, effect of pesticides on environment, soil, human and animal health, merits and demerits of pesticide uses in agriculture; concept of pesticide residue analyses; management of pesticide residues for sustainable agriculture.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand agrochemicals: their type and role in agriculture, effect of pesticides on environment, soil, human and animal health.
- Know merits and demerits of pesticide uses in agriculture, concept of pesticide residue analyses
- Learn management of pesticide residues for sustainable agriculture.
- Understand herbicides: major classes, chemical properties and use of some important herbicides,fate of herbicides in the environment.
- Understand fungicides: classification; Inorganic fungicides - characteristics, preparation and use of sulphur and copper,

CourseContent

UNIT– I **06Hours**

- An Introduction to agrochemicals: their type and role in agriculture,
- Effect of pesticides on environment, soil, human and animal health, merits and demerits of pesticide uses in agriculture.
- Concept of pesticide residue analyses; management of pesticide residues for sustainable agriculture.
- Herbicides: major classes, chemical properties and use of some important herbicides
- Fate of herbicides in the environment.

UNIT-II **06Hours**

- Soil and climate, moisture stress and drought
- Fungicides: classification; Inorganic fungicides –
- characteristics, preparation and use of sulphur and copper,
- Mode of action- Bordeaux mixture and copper oxychloride;
- Organic fungicides - Mode of action

UNIT-III **06Hours**

- Dithiocarbamates- characteristics, preparation and use of Zineb and Maneb.
- Systemic fungicides: Benomyl, carboxin, oxycarboxin,
- Metalaxyl, Carbendazim - characteristics and use.
- Insecticides: introduction and classification;
- Inorganic and organic insecticides

UNIT-IV **06Hours**

- OrganochlorineOrganophosphates, Carbamates,
- Synthetic pyrethroids, Neonicotinoids, IGRs,
- Reduced risk insecticides;
- Fate of insecticides in soil and plant; plant and animal systemic insecticides
- Their characteristics and uses.

PRACTICAL

UNIT-V06 Hours

- Sampling of pesticides, Pesticides application technology to study about various pesticides appliances;
- Calculation of doses of pesticides to be used; To study and identify various formulations of insecticide available in market;

- Identification of agro-chemicals using TLC: Preparation of TLC plate, spotting and development,
- visualization and calculation of R_f; Determination of copper content in copper oxychloride;
- Determination of thiram content. Determination of ziram content; Determination of alachlorcontent.

Recommended Books:(LatestEditions)

- Roy N K: Chemistry of Pesticides, CBS Publishers,
- Melnikov N N, Busbey, R L, Gunther, F A and Gunther J D: Chemistry of Pesticides **,** Springer

Reference Books

- Stenersen J : Chemical Pesticides Mode of Action and Toxicology, CRC Press
- Ohkawa H, Miyagawa H, Lee P W: Pesticide Chemistry: Crop Protection, Public Health, Environmental Safety, Wiley-VCH Verlag GmbH & Co. KGaA

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 262.1	2	2	2	-	2	-	2	-	1	-	-	2
EC 262.2	2	1	3	3	-	2	-	2	-	-	3	2
EC 262.3	3	-	2	3	-	1	2	2	-	-	2	-
EC 262.4	1	3	2	2	-	3	1	1	2	-	1	-
EC 262.5	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**EC 263**
Course Title	**CHEMICALS AND BIOFUNGICIDES IN PLANT DISEASE**

	MANAGEMENT			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	35			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on chemicals and bio-fungicides in plant disease management,disadvantages of chemicals, chemical nature, characteristics and classification.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand history and development of chemicals, advantages and disadvantages of synthetic chemical fungicides.
- Know formulation of different fungicides-types, uses, advantages, adjuvant, stickers and spreaders.Mode of action and application of different fungicides.
- Learn Chemical nature and mode of action of different antibiotics. New molecules in plant disease management, Antibiotics resistance in Plant pathogens.Development of fungicidal resistance.
- Understand herbicides: major classes, chemical properties and use of some important herbicides, fate of herbicides in the environment.
- Understand biofungicides of microbial origin: introduction and importance. Examples of biocontrol agents and characteristics, Principles and mode of action. Botanicals and novel compound in plant disease management.

CourseContent

UNIT– I **06 Hours**

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- History and development of chemicals,
- Advantages and disadvantages of chemicals.
- Concept of pesticide residue analyses;
- Management of pesticide residues for sustainable agriculture

- Formulation of different fungicides-types, uses, advantages, adjuvant, stickers and spreaders.

UNIT-II **06 Hours**

- Mode of action and application of different fungicides.
- Chemical nature and mode of action of different antibiotics.
- New molecules in plant disease management.
- Antibiotics resistance in Plant pathogens.
- Development of fungicidal resistance.

UNIT-III **07 Hours**

- General account of plant protection appliances.
- Biofungicides of microbial origin: introduction and importance.
- Examples of biocontrol agents and characteristics,
- Principles and mode of action.
- Botanicals and novel compound in plant disease management.

UNIT-IV 0**7 Hours**

- OrganochlorineOrganophosphates, Carbamates,
- Isolation and maintenance.
- Mass production and formulation;
- Delivery systems.Application technology.
- Advantages, disadvantages and future prospects.

PRACTICAL

UNIT-V07 Hours

- Sampling of pesticides, Pesticides application technology to study about various pesticides appliances;Acquaintance with formulation of different fungicides and plant protection appliances.
- Studies on fungicides application equipment-types of sprayers, dusters and nozzles.Poisoned food technique.

- Preparation of different concentrations of chemicals based on active ingredients against pathogens; Minimum inhibitory concentration (MIC) of different antibiotics against plant pathogenic bacteria.
- Isolation of biocontrol agents in culture media, Morphology and testing for bioactivity (dual culture technique).Preservation techniques of biocontrol agents.Mass culture of biocontrol agents.
- Formulation, packaging and labelling. Application in pot and field. Cost determination and pricing.

Recommended Books:(LatestEditions)

- Ohkawa H ,Miyagawa H, Lee P W: Pesticide Chemistry: Crop Protection, Public Health, Environmental Safety, Wiley-VCH Verlag GmbH & Co. KGaA
- Roy N K: Chemistry of Peasticides, CBS Publishers,
- Joshi S R: Biopesticides: A Biotechnological Approach, New Age International Private Limited

Reference Books

- Stenersen J : Chemical Pesticides Mode of Action and Toxicology, CRC Press
- Ohkawa H, Miyagawa H, Lee P W: Pesticide Chemistry: Crop Protection, Public Health, Environmental Safety, Wiley-VCH Verlag GmbH & Co. KGaA

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 263.1	2	2	2	-	2	-	2	-	1	-	-	2
EC 263.2	2	1	3	3	-	2	-	2	-	-	3	2
EC 263.3	3	-	1	-	-	1	2	2	-	-	2	1
EC 263.4	1	3	2	2	-	3	1	1	2	-	1	1
EC 263.5	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**EC 264**			
Course Title	**PLANT AND MOLECULAR BIOLOGY**			
Category				
LTP & Credits	L	T	P	Credits

	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on plant molecular biology in relation to photosynthesis – biological redox process, site of occurrence, chemistry and biosynthesis of chlorophyll and carotenoids. Light absorption and energy conversion, chemistry of reaction centre complex, structure of photosystems.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand Photosynthesis – biological redox process, site of occurrence, Chemistry and biosynthesis of chlorophyll and carotenoids,light absorption and energy conversion, chemistry of reaction, center complex, structure of photosystems.
- UnderstandExperimental evidences of Z-scheme, photosynthetic electron transport and inhibitors, , oxidation of water. chemiosmotic hypothesis and binding change mechanism of ATP synthesis.
- Understand the overview of nitrate uptake, reduction and nitrogen fixation.chemistry of NR and NiR, regulation of NR, interaction between NO_3 assimilation and carbon metabolism.
- Establish DNA as genetic material, Central dogma; replication, transcription and translation-
- Understand the molecular mechanism and sequential events, discussion on enzymes/ protein factors involved, structural features of t-RNAs, : Genetic code – characteristics, wobble base pairing : post transcriptional and post translational processing, inhibitors.

CourseContent

UNIT– I **06 Hours**

- Photosynthesis – biological redox process, site of occurrence
- Chemistry and biosynthesis of chlorophyll and carotenoids
- Light absorption and energy conversion, chemistry of reaction center complex,
- Structure of photosystems including PS I and PS II,
- Lateral heterogeneity, experimental evidences of Z-scheme,

UNIT-II **06 Hours**

- Photosynthetic electron transport and inhibitors, ,
- Oxidation of water. chemiosmotic hypothesis and binding change mechanism of ATP synthesis
- C-linked reactions in C_3, C_4 and CAM plants and their regulation,
- photorespiratory cycle
- Response of C_3 and C_4 plants to future climatic events.

UNIT-III **06Hours**

- Overview of nitrate uptake, reduction and nitrogen fixation.
- chemistry of NR and NiR, regulation of NR,
- Interaction between NO_3 assimilation and carbon metabolism.
- DNA as genetic material, Central dogma; replication, transcription and translation-
- Molecular mechanism and sequential events,

UNIT-IV **06 Hours**

- OrganochlorineOrganophosphates, Carbamates,
- Discussion on enzymes/ protein factors involved,
- Structural features of t-RNAs
- Genetic code – characteristics, wobble base pairing
- post transcriptional and post translational processing, inhibitors.

PRACTICAL

UNIT-V06Hours

- Estimation of starch;
- Extraction and estimation of phenolics from plant materials;
- Colorimetric and titrimetric estimation of vitamin C in fruits and vegetables;
- Extraction and estimation of chlorophyll, carotenoids, lycopene, curcumin etc. from plant materials,
- Determination of Michaelis-Mentenconstant, estimation of some enzyme activities.

Recommended Books:(LatestEditions)

- Arora M P anf Arora H:Text Book of Molecular Biology, Himalaya Publishing House
- Malathi V: Essentials of Molecular Biology, Pearson Education India

Reference Books

- Grienson D and Covey SN: Plant Molecular Biology, Springer Nature, Switzerland
- Buchanan B B, Gruissem W and Jones RL: Biochemistry and Molecular Biology of Plants,Willey Blackwell**.**

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 264.1	2	2	2	-	2	-	-	-	1	-	-	2
EC 264.2	3	1	3	3	-	2	-	2	-	-	3	2
EC 264.3	3	-	2	3	2	1	2	2	-	-	2	-
EC 264.4	1	3	2	2	-	3	1	1	2	-	1	-
EC 264.5	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**EC 265**
Course Title	**AGRICULTURAL JOURNALISM**

Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on Agricultural Journalism,the nature and scope of agricultural journalism, characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the nature and scope of agricultural journalism, characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.
- Understand newspapers and magazines as communication media, characteristics, kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines.
- Understand style and language of newspapers and magazines, parts of newspapers and magazines. The agricultural story: types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story.
- Understand to gather agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.
- Know how to write the story: organizing the material, treatment of the story, writing the news lead and the body, readability measures. illustrating agricultural stories: use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. editorial mechanics: copy reading, headline and title writing, proofreading, lay outing

CourseContent

UNIT– I **06 Hours**

- Agricultural Journalism: The nature and scope of agricultural journalism,
- Characteristics and training of the agricultural journalist,
- How agricultural journalism is similar to and different from other types of journalism. Newspapers and magazines as communication media,
- Characteristics; kinds and functions of newspapers and magazines,
- characteristics of newspaper and magazine readers

UNIT-II **06 Hours**

- Form and content of newspapers and magazines:
- Style and language of newspapers and magazines, parts of newspapers and magazines.
- The agricultural story: Types of agricultural stories,
- subject matter of the agricultural story, structure of the agricultural story.
- Gathering agricultural information:

UNIT-III **06 Hours**

- Sources of agricultural information, interviews, coverage of events
- Abstracting from research and scientific materials,
- Wire services, other agricultural news sources.
- Writing the story: organizing the material, treatment of the story,
- Writing the news lead and the body,.

UNIT-IV **06 Hours**

- Readability measures. Illustrating agricultural stories:
- Use of photographs, use of artwork (graphs, charts, maps, etc.)
- Writing the captions.
- Editorial mechanics: Copy reading,
- Headline and title writing, proofreading, lay outing

PRACTICAL

UNIT-V06 Hours

- Practice in interviewing. Covering agricultural events.
- Abstracting stories from research and scientific materials and from wire services.
- Writing different types of agricultural stories.
- Selecting pictures and artwork for the agricultural story.
- Practice in editing, copy reading, headline and title writing, proofreading, layouting. Testing copy with a readability formula. Visit to a publishing office.

Recommended Books:(LatestEditions)

- Singh A K :Agricultural Extension and Farm Journalism, Biogreen Books Publishers
- Jana B L: Agricultural Journalism, Agrotech Publishing Academy

Reference Book;

- Groot HC: Agricultural Jounalism, University of Philipines, College of Agriculture, Philipines.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 265.1	2	2	2	-	2	2	-	1	1	-	-	2
EC 265.2	2	1	3	3	-	2	-	2	-	-	3	2
EC 265.3	3	3	2	3	-	1	2	2	-	-	2	2
EC 265.4	1	3	2	2	-	3	1	1	2	-	1	
EC 265.5	3	2	1	1	-	-	-	-	-	-	2	

Course Code	**EC 266**			
Course Title	**AGRI-BUSINESS MANAGEMENT**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			

Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems.Importance of agribusiness in the Indian economy and new agricultural policy.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems and importance of agribusiness in the Indian economy and New Agricultural Policy.
- Understand distinctive features of Agribusiness Management: importance and needs of agro-based industries, classification of industries and types of agro based industries. institutional arrangement, procedures to set up agro based industries
- Constraints in establishing agro-based industries.Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis.Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget.
- Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance.
- Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behavior analysis, Product Life Cycle (PLC).Sales & Distribution Management.Pricing policy, various pricing methods.Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation.Project Appraisal and evaluation techniques.

CourseContent

UNIT– I **06 Hours**

- Transformation of agriculture into agribusiness, various stakeholders and components of

agribusiness systems

- .Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management:
- Importance and needs of agro-based industries, Classification of industries and types of agro based industries.
- Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries.Agri-value chain
- Understanding primary and support activities and their linkages.

UNIT-II **06 Hours**

- Business environment: PEST & SWOT analysis.
- Management functions: Roles & activities,
- Organization culture. Planning, meaning, definition, types of plans.
- Purpose or mission, goals or objectives,
- Sources of agricultural information, interviews, coverage of events

UNIT-III **06 Hours**

- Strategies, polices procedures, rules, programs and budget.
- Components of a business plan, Steps in planning and implementation.
- Organization staffing, directing and motivation.
- Ordering, leading, supervision, communications, control..
- Capital Management and Financial management of Agribusiness.

UNIT-IV **06 Hours**

- Financial statements and their importance.Marketing Management: Segmentation, targeting & positioning.
- Marketing mix and marketing strategies. Consumer behavior analysis,

- Product Life Cycle (PLC).Sales & Distribution Management.Pricing policy, various pricing methods.
- Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation.
- Project Appraisal and evaluation techniques.

PRACTICAL

UNIT-V06 Hours

- Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products.
- Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD.
- Preparations of projects and Feasibility reports for agribusiness entrepreneur.Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques.
- Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities.
- Net present worth technique for selection of viable project.Internal rate of return.

Recommended Books:(LatestEditions)

- Diwase S: Indian Agriculture & Agri-Business Management, Scientific Publishers
- Acharya S S: Agriculture Marketing in India,Oxford& IBH Publishing

Reference Books

- Meena G L: Agribusiness Management, Agritech Publishing Academy
- Broadway A C: A text Book of Agribusiness Management, Kalyani Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12

EC 266.1	2	2	2	-	-	-	-	-	1	-	-	
EC 266.2	2	1	3	3	-	2	-	2	-	-	3	
EC 266.3		3		3	-	1	2	2	-	-	2	
EC 266.4	1	3	2	2	-	3	1	1	2	-	1	
EC 266.5	3	2	1	1	-	-	-	-	-	-	2	

SEMESTER V

Course Code	**AGR 301**			
Course Title	**CROP PRODUCTION TECHNOLOGY IV (*KHARIF CROPS*)**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of fibre crops, commercial crops, medicinal and aromatic crops

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept of high value commercial crop cultivation
- Know agricultural practices of fibre crops: Jute, Cotton and Sun hemp
- Understand the agrotechnology of commercial crops: Sugarcane and Sugarbeet
- Learn the agricultural practices for cultivation of medicinal and aromatic Mentha, Citronella, Lemon grass, Palmarosa, Isabgul and Poppy
- Learn the post-harvest processing of aromatic plant biomass and seeds of Isabgol, the medicinal plant

CourseContent

UNIT– I **08Hours**

- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of fibre crops: Jute, Cotton and Sun hemp
- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of commercial crop: Sugarcane and Sugar beet
- Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Medicinal and Aromatic Plants: Palmarosa (*Cymbopogon martini*), Citronella (*Cymbopogon winterianus*), Lemongrass (*Cymbopogon flexuosus*), Mentha (*Mentha arvensis*) and Isabgol*(Plantago ovata*) and Poppy (*Papaversomniferum*)

- Processing of fresh herb of aromatic grasses and thehusk and seeds of Plantago.
- Fractionation of the essential oils by Gc and GC-MS

PRACTICAL

UNIT-II **08Hours**

- Field preparation, sowing of fibre, commercial, medicinal and aromatic crops, and inter / mix cropping
- Calculations of seed rate and fertilizers
- Effect of seed size and sowing depth on germination and seeding vigour of fibre, commercial, medicinal and aromatic crops
- Top dressing and foliar feeding of nutrients
- Identification of weeds and their control measures,

UNIT-III **08Hours**

- Important intercultural operations and water management
- Study of varieties, yield contributing characters,
- Yield estimation of important fibre, commercial, medicinal and aromatic crops
- Cost of cultivationall the high value crops
- Crop distribution in West Bengal and its ecological regions
- Study of crop varieties and important agronomic experiments at experimental farms;
- Visit to research stations for related *kharif* crops and multiple cropping.

Recommended Books:(LatestEditions)

- KhareD:SeedTechnology.2ndEd., Scientific Publishers
- DasNR:IntroductiontoCropsofIndia.2nd, Kalyani Publishers
- JatML:DrylandTechnology2ndEd., Scientific Publishers

Reference Books

- SharmaR:ResourceConservingTechniquesinCropProduction, ICAR, New Delhi
- GhoshPK:ResourceConservationTechnologyinPulses, Scientific Publishers
- Khare,D.:FarmMechanizationforProductionofPulses, Scientific Publishers
- FAOBulletin:TheUseofSalineWatersforCropProduction, FAO,Rome.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
AGR 301.1	2	3	3	-	2	-	-	-	1	-	-	-
AGR 301.2	3	1	3	3	2	2	-	2	-	-	3	-
AGR 301.3	-	2	2	3	2-	1	2	2	-	-	2	2
AGR 301.4	2	3	2	2	-	3	1	1	2	-	1	2
AGR 301.5	1	2	1	1	-	-	-	-	-	-	2	2

Course Code	**AGR 302**			
Course Title	**RAINFED AGRICULTURE AND WATERSHED MANAGEMENT**			
Category				
LTP & Credits	L	T	P	Credits

	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on cultivation practices of crops under rainfed conditions.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept of rainfed condition
- Appreciate that physio-morphological characteristics play a significant role in crop sustainability
- Realize that there is absolute necessity of conservation of soil and water resources
- Understand that there is a contingent crop planning for aberrant weather conditions
- Pick up the suitable cropping system under such agro-climatic conditions under rainfed situation

CourseContent

UNIT– I **05Hours**

- Rainfed agriculture: history, introduction and types
- Soil and climatic conditions prevalent in rainfed areas
- Drought: types, effect of water deficit on physio-morphological characteristics of the plants
- Soil and water conservation methods
- Crop adaptation and mitigation to drought

UNIT-II **05 Hours**

- Efficient utilization of water through soil and crop management practices
- Management of crops in rainfed areas
- Cropping system, agronomic management including choice of crops / varieties
- Soil and water conservation techniques

- Anti-transpirants; drought avoidance / mitigation practices

UNIT-III **05 Hours**

- Contingent crop planning
- Water harvesting: importance and its techniques
- Soil and tidal water management
- Watershed management: history, concept, objectives, principles, components, influential factors,
- Agronomic management: choice of crops and cropping system

PRACTICAL

UNIT IV **05 Hours**

- Study on rainfall pattern in rainfed areas of the country
- Study on cropping pattern of different rainfed areas
- Rainfall analysis: Frequency, intensity, duration and probability
- Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops
- Calculation on scheduling of irrigation for different crops

UNIT V **05 Hours**

- Study on cultural practices for mitigating moisture stress
- Field demonstration on soil and moisture conservation measures
- Field demonstration on construction of water harvesting structures;
- Analysis of case studies of some identified watersheds and their management in different agro-climatic conditions;
- Visit to rainfed research station / watershed.

Recommended Books:(LatestEditions)

- Gupta,S.K.:ManagementofSaline&WasteWaterinAgriculture, Scientific

Publishers

- G.P.Verma:RainfedFarmingDevelopmentinCentralIndia, Scientific Publishers
- Jat,M.L.:RainwaterManagementTheoryandPractice, ICAR, India

Reference Books

- FAO:WasteWaterManagementandUseinAgriculture, Rome
- Smith:TestingandEvaluationofAgriculturalMachineryandEquipment, FAO Bulletin, Rome
- FAO:IrrigationDrainageandSalinity:AnInternationalSourceBook, Rome
- FAO:ControlofWaterPollutionfromAgriculture, FAO, Rome
- GuptaSK:DrainageEngineering:PrinciplesandPractices, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
AGR 302.1	2	3	3	-	-	-	-	-	1	-	-	
AGR 302.2	3	1	3	3	-	2	-	2	-	-	3	
AGR 302.3	3	-	2	3	-	1	2	2	-	-	2	
AGR 302.4		3	2	2	-	3	1	1	2	-	1	
AGR 302.5	1	2	1	1	-	-	-	-	-	-	2	

Course Code	**GPB 303**			
Course Title	**CROP IMPROVEMENT II (*KHARIF CROPS*)**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2

Total Contact Hours	25
Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on improvement in the *Kharif* crop varieties with respect to yield, quality, and resilient to biotic and abiotic stress.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept of crop improvement through conventional and modern breeding approach
- Understandplant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters
- Visualize important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops
- Learn major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield and other traits.
- Learn hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc

CourseContent

UNIT– I **05Hours**

- Centres of origin, distribution of species,
- Wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops;
- Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters
- Drought: types, effect of water deficit on physio-morphological characteristics of the plants
- Important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops;

UNIT-II **05 Hours**

- Major breeding objectives and procedures including conventional and modern innovative approaches
- Development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional)
- Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc.
- Ideotype concept and climate resilient crop varieties for future.
- Genetically modified crops

PRACTICAL

UNIT-III **05 Hours**

- Contingent crop planning
- Water harvesting: importance and its techniques
- Soil and tidal water management
- Watershed management: history, concept, objectives, principles, components, influential factors,
- Agronomic management: choice of crops and cropping system

UNIT IV **05 Hours**

- Study on rainfall pattern in rainfed areas of the country
- Floral biology, emasculation and hybridization techniques in different crop species
- Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean,
- Soybean, Groundnut, Seasame, Caster, Cotton, Cowpea, Tobacco, Brinjal,
- Okra and Cucurbitaceous crops.
-

UNIT V **05 Hours**

- Maintenance breeding of different *kharif* crops.
- Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods

- Study of field techniques for seed production and hybrid seeds production in *Kharif* crops
- Estimation of heterosis, inbreeding depression and heritability;
- Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

Recommended Books:(LatestEditions)

- SinghB.D:MolecularPlantBreeding, Kalyani Publishers
- Bhardwaj DN: Breeding of Field Crops, Agrobios (India)

Reference Books

- Acquash G: Principles of genetics and Plant Breeding, Blackwell Publishing
- StoskopfNC:Plantbreeding:theoryandPractice, CRC Press

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
GPB 303.1	2	3	3	-	2	-	2	-	1	-	-	2
GPB 303.2	3	1	3	3	-	2	-	2	-	-	3	-
GPB 303.3	3	-	2	3	-	1	2	2	-	-	2	-
GPB 303.4		3	2	2	-	3	1	1	2	-	1	-
GPB 303.5	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**ABT 304**
Course Title	**PRINCIPLES AND PRACTICES OF AGRICULTURAL BIOTECHNOLOGY**
Category	

LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on concepts and scope of plant biotechnology in agriculture.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept of plant biotechnology and its role in agriculture
- Learn tissue culture- culture media and aseptic manipulation
- Learn types of culture- organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications
- Learn rDNA technology and gene cloning
- Understand Transgenics and its importance in crop improvement

CourseContent

UNIT– I **05Hours**

- Concepts and scope of plant biotechnology
- Introduction to plant tissue culture- culture media and aseptic manipulation
- Types of culture- organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications
- Organogenesis and embryogenesis;
- Micro-propagation methods

UNIT-II **05 Hours**

- Synthetic seeds and their significance
- Embryo rescue and its significance
- Somatic hybridization and cybrids
- Somaclonal variation and its use in crop improvement;
- Cryo-preservation.

UNIT-III **05 Hours**

- Contingent crop planning
- Introduction to rDNA technology and gene cloning,
- Physical (Gene gun method), chemical (PEG mediated) and *Agrobacterium* mediated gene transfer methods;
- Transgenics and its importance in crop improvement;
- PCR techniques and its applications; RFLP, RAPD, SSR; Biotechnology regulations.

PRACTICAL

UNIT IV **05 Hours**

- Sterilization techniques,
- Preparation of MS medium,
- Fresh culture and Sub-culture,
- Micro-propagation-hardening and acclimatization,
- Synthetic seed development

UNIT V **05 Hours**

- Demonstration on isolation of DNA,
- Demonstration on PCR amplification,
- Demonstration of gel electrophoresis techniques and DNA finger printing.

Recommended Books:(LatestEditions)

- SaxenaJ:LaboratoryManualofMicrobiology,BiochemistryandMolecularBiology, Scientific Publishers
- Saxen,J:ComprehensiveLaboratoryManualofLifeScience, Scientific

Publishers

Reference Books

- PuniaMS:PlantBiotechnologyandMolecularBiology-ALaboratoryManual, Scientific Publishers
- BalaM:PracticalsinPlantPhysiologyandBiochemistry, Scientific Publishers
- RaiMK:RecentTrendsinBiotechnology, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
ABT 304.1	2	3	3	-	2	2	-	-	1	-	-	2
ABT 304.2	3	1	3	3	-	2	-	2	-	-	3	2
ABT 304.3	3	-	2	3	1	1	2	2	-	-	2	
ABT 304.4	2	3	2	2	-	3	1	1	2	-	1	
ABT 304.5	1	2	1	1	1	-	-	-	-	-	2	

Course Code	**ACSS 305**			
Course Title	**PROBLEMATIC SOILS AND THEIR MANAGEMENT**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on soils which are stressed by many reasons viz. salinity, sodicity, acidity, contamination, eroded structure, submerged, acid sulphate soils and their economic use.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the reasons for soil becoming problematic (physical, chemical and biological means)
- Learn using wastelands prone to biotic and abiotic stress by advanced cultural practices
- Understand the technologies for reclamation of stressed soils
- Know the technique of bioremediation of wasteland using multipurpose trees (MPT)
- Follow problem based crops and cropping systems

CourseContent

UNIT– I **06Hours**

- Soil quality and health,
- Distribution of Waste land and problem soils in India.
- Their categorization based on properties.
- Reclamation and management of Saline and sodic soils,
- Acid soils, Acid Sulphate soils,

UNIT-II **06 Hours**

- Eroded and Compacted soils,
- Flooded soils,
- Polluted soils.
- Poor quality of irrigation water

- Irrigation water – quality and standards,

UNIT-III **06 Hours**

- Utilization of saline water in agriculture.
- Remote sensing and GIS in diagnosis and management of problem soils.
- Multipurpose tree species, bio remediation through MPTs of soils,
- Land capability and classification, land suitability classification.
- Problematic soils under different Agro-ecosystems

PRACTICAL

UNIT IV **06 Hours**

- pH, Electrical conductivityand ESP of the saturation extract of the saline soil.
- SAR and Gypsum requirement of sodic soils.
- Lime requirement and Gypsum requirement of problem soils.
- Parameters of quality of irrigation water.
- Determination of lime requirement of acid soils

Recommended Books:(LatestEditions)

- Gupta SK:ManagementofSaline&WasteWaterinAgriculture, Scientific Publishers
- RamuluUSS:PrinciplesinTheQuantitativeAnalysisofWater,Fertilizers,Plants andSoils, Scientific Publishers
- GargBK:SalineWastelandsEnvironmentandPlantGrowth, Scientific Publishers

Reference Books

- GargBK:SalinityToleranceinPlants:Methods,MechanismsandManagem ent, Scientific Publishers
- GuptaSK:SaltAffectedSoils:ReclamationandManagement, Scientific

Publishers

- GuptaIC:CropProductioninSaltAffectedSoils, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
ACSS 305.1	2	3	3	-	2	-	-	-	1	-	-	2
ACSS 305.2	3	1	3	3	-	2	-	2	-	-	3	1
ACSS 305.3	3	-	2	3	-	1	2	2	-	-	2	-
ACSS 305.5		3	2	2	-	3	1	1	2	-	1	-
ACSS 305.6	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**AEPP 306**

Course Title	PRINCIPLES OF INTEGRATED PEST AND DISEASE MANAGEMENT			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: This course is designed to impart a comprehensive knowledge on Integrated Pest Management its history, importance, concepts, principles and tools.

Objectives: Upon completion of this course the students should be able to:

- Understand the concept of Integrated Pest Management and its use as a safe technology
- Learn the methods of detection and diagnosis of insect pests and diseases
- Learn the methods of detection and diagnosis of insect pests and diseases.
- Learn pest control: host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control.
- Follow development and validation of IPM module.

Course Content

UNIT– I **06 Hours**

- Categories of insect pests,
- IPM: Introduction, history, importance, concepts, principles and tools.
- Economic importance of insect pests, diseases and pest-disease risk analysis.
- Methods of detection and diagnosis of insect pests and diseases.
- Calculation and dynamics of economic injury level and importance of Economic threshold level..

UNIT-II **06 Hours**

- Methods of control: host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control
- Ecological management of crop environment.
- Different aspects of plant bio-security, bio-safety and preventive measures.
- Introduction to conventional pesticides for the insect pests management.
- Survey surveillance and forecasting of Insect pests

UNIT-III **06 Hours**

- Utilization of saline water in agriculture.
- Development and validation of IPM module.
- Implementation and impact of IPM (IPM module for Insect pest and disease).
- Safety issues in pesticide uses.
- Political, social and legal implication of IPM.
- Case histories of important IPM programmes.

PRACTICAL

UNIT IV **06 Hours**

- Methods of diagnosis and detection of various insect pests, and plant diseases,
- Methods of insect pests and plant disease measurement,
- Assessment of crop yield losses, calculations based on economics of IPM,
- Identification of biocontrol agents, different predators and natural enemies.
- Mass multiplication of *Trichoderma*, *Pseudomona*s, *Trichogramma*, NPV etc.

UNIT V **06 Hours**

- Identification and nature of damage of important insect pests and diseases and their management.
- Crop (agro-ecosystem) dynamics of a selected insect pest and diseases.
- Plan & assess preventive strategies (IPM module) and decision making.

- Monitoringof cropsattacked by insect, pestand diseases.
- Performance study of hot water treatments of fruits and vegetables.

Recommended Books:(LatestEditions)

- ManoharacharyC:FrontiersinMicrobialBiotechnologyandPlantPathology, Scientific Publishers
- GuptaVK:IntegratedDiseaseManagementandPlantHealth, Scientific Publishers

Reference Books

- RaiMK:IntegratedManagementofPlantResources, Scientific Publishers
- SharmaRC:IntegratedPlantDiseaseManagement, Scientific Publishers
- ReddyS.M:IntegratedPlantPathology, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AEPP 306.1	2	3	3	-	2	-	-	-	1	2	-	2
AEPP 306.2	3	1	3	3	2	2	-	2	-	2	3	1
AEPP 306.3	2	-	2	3	-	1	2	2	-	-	2	1
AEPP 306.4		3	2	2	-	3	1	1	2	-	1	-
AEPP 306.5	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**AEC 307**
Course Title	**FARM MANAGEMENT, PRODUCTION AND RESOURCE**

	ECONOMICS			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge onprinciples of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand meaning and definition of farm management, its types and characteristics, factor determining types and size of farms.
- Understand the Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage.
- Understand meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income
- Understand farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts.
- Understand meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.

CourseContent

UNIT– I **08 Hours**

- Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms.
- Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage
- Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income.
- Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises
- Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts

UNIT-II **08 Hours**

- Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts
- Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises.
- Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies**,**
- Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources.
- Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions,
- Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

PRACTICAL

UNIT III **08 Hours**

- Preparation of farm layout.Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets.,
- Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.
- Determination of most profitable level of inputs use in a farm production process,
- Selection of most profitable enterprise combination.
- Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises.
- Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

Recommended Books:(LatestEditions)

- YadavSL: AgriculturalPlanninginIndia,Scientific Publishers
- FAO Bulletin:FarmBusinessSchool, FAO, Rome

Reference Books

- ObstWJ:FinancialManagementforAgribusinessl Landlinks Press
- DiwaseS:IndianAgriculture&AgribusinessManagement,3rdEd. Scientific Publishers
- FrancisL:FarmersTrainingEntrepreneurshipManual, World Forestry Centre, Nairobi, Kenya

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AEC 307.1	2	3	3	-	-	-	-	-	1	-	-	2
AEC 307.2	3	1	3	3	-	2	-	2	-	-	3	2
AEC 307.3	3	-	2	3	-	1	2	2	-	-	2	-
AEC 307.4		3	2	2	-	3	1	1	2	-	1	-
AEC 307.5	1	2	1	1	-	-	-	-	-	-	2	-

Course Code	**AEX 308**
Course Title	**ENREPRENEURSHIP DEVELOPMENT AND BUSINESS**

	COMMUNICATION			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamental knowledge on Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs. SWOT Analysis and achievement motivation. Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness. Agri enterprises, Entrepreneurial Development Process; Business Leadership Skills

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the concept of concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs. SWOT Analysis & achievement motivation
- Learn Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness.
- Learn Entrepreneurial Development Process; Business Leadership Skills, Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation. Developing Managerial skills:
- Know theCommunication, direction and motivation skills, Problem solving skill. Supply chain management and Total quality management
- Follow the Project Planning,Formulation and Evaluation. Opportunities for agri-entrepreneurship and rural enterprise and Financing of enterprise.

CourseContent

UNIT– I **05Hours**

- Concept of Entrepreneur, Entrepreneurship Development
- Characteristics of entrepreneurs. SWOT Analysis and achievement motivation

- Government policy and programs and institutions for entrepreneurship development
- Impact of economic reforms on Agribusiness
- Agrienterprises, Entrepreneurial Development Process

UNIT-II **05Hours**

- Methods of control: host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control
- Ecological management of crop environment.
- Different aspects of plant bio-security, bio-safety and preventive measures.
- Introduction to conventional pesticides for the insect pests management.
- Survey surveillance and forecasting of Insect pests

UNIT-III **05Hours**

- Business Leadership Skills
- Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation.
- Developing Managerial skills: Communication, direction and motivation skills
- Supply chain management and Total quality management
- Project Planning, Formulation and Evaluation
- Opportunities for agri-entrepreneurship and rural enterprise.Financing of enterprise.

PRACTICAL

UNIT IV **05Hours**

- Methods of diagnosis and detection of various insect pests, and plant diseases,
- Methods for Assessing entrepreneurial traits.
- Techniques of Managerial skills and achievement motivation.
- Creativity Exercise.
- Identification and selection of business idea

UNIT V **05 Hours**

- Preparation of business plan and proposal writing,
- Visit to entrepreneurship development institute and entrepreneurs.
- Methods for problem solving skills.
- Project formulation in terms of Time, Cost, resource and Management.
- SWOT analysis and Exercise.

Recommended Books:(LatestEditions)

- RathakrishnanT:AgroEnterprisesforEmpoweringFarmWomen, Scientific Publishers
- PanigrahyS.R:Agro-Entrepreneurship, ICAR, New Delhi
- KadamJ.R:CommunicationSkillsandPersonalityDevelopment, Scientific Publishers

Reference Books

- CholeR.R.:EntrepreneurshipDevelopmentandCommunicationSkills, Scientific Publishers
- KhanD:EntrepreneurshipinFarming, ICAR, New Delhi
- Francis L:FarmersTrainingEntrepreneurshipManualFrancis, Scientific Publishers, India

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AEX 308.1	2	3	3	-	2	-	-	-	1	2	-	-
AEX 308.2	3	1	3	3	-	2	-	2	-	2	3	-
AEX 308.3	3	-	2	3	2	1	2	2	-	-	2	2
AEX 308.4		3	2	2	-	3	1	1	2	-	1	2
AEX 308.5	1	2	1	1	-	-	-	-	-	-	2	1

Course Code	HORT (A) 309

Course Title	PRODUCTION TECHNOLOGY OF ORNAMENTAL CROPS MAPS AND LANDSCAPING			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on production technology of ornamental crops, medicinal and aromatic crops and landscaping

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn the importance and scope of ornamental crops, medicinal and aromatic plants and landscaping.
- Learn principles of landscaping, landscape uses of trees, shrubs and climbers.
- Learn production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions.
- Know the Package of practices for loose flowers like marigold, tuberose and jasmine under open conditions.
- Follow the production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce..

CourseContent

UNIT– I **06Hours**

- Concept of Entrepreneur, Entrepreneurship Development
- Importance and scope of ornamental crops,
- High value medicinal and aromatic plants and
- Landscaping.Principles of landscaping.Landscape uses of trees, shrubs and climbers.

- Production technology of important cut flowers

UNIT-II **06 Hours**

- Important cut flowers like rose, gerbera, carnation etc
- Lilium and orchids under protected conditions and
- Gadiolus, tuberose, *Chrysanthemum* under open conditions.
- Package of practices for loose flowers like marigold, tuberose and jasmine under open conditions.
- Production technology of important medicinal plants

UNIT-III **06 Hours**

- Medicinal and aromatic plants
- Ashwagandha, Asparagus, Aloe, Costus, Cinnamomum, periwinkle, isabgol and
- aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver.
- Processing and value addition in ornamental crops and MAPs produce.
- Estimating economics in developing entrepreneurship on ornamentals, cut flowers and land scaping

PRACTICAL

UNIT IV **06 Hours**

- Identification of Ornamental plants.Identification of Medicinal and Aromatic Plants.
- Nursery bed preparation and seed sowing.
- Training and pruning of Ornamental plants
- Planning and layout of garden.Bed preparation and planting of MAP.
- Protected structures – care and maintenance.Intercultural operations in flowers and MAP.
- Harvesting and post-harvest handling of cut and loose flowers.

- Processing of MAP. Visit to commercial flower/MAP unit.

Recommended Books:(LatestEditions)

- SinghSP:AdvancesinHorticultureandForestry(1-9), Scientific Publishers
- SoodSK:FlavouringandFragrantResourcesofIndia, Scientific Publishers

Reference Books

- SudRK:FlowersandVegetablesofIndia, ICAR, New Delhi
- ChopraVL:OrnamentalPlantsforGardening, Scientific publishers
- BarlowHS:TropicalPlantingandGardeningEd. 6th, Malayan Nature Society

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
HORT (A) 309.1	2	3	3	-	-	-	-	-	1	-	-	-
HORT (A) 309.2		1	3	3	-	2	-	2	-	2	3	-
HORT (A) 309.3	3	3	2	3	4	1	2	2	-	-	2	1
HORT (A) 309.4		3	2	2	2	3	1	1	2	2	1	1
HORT (A) 309.5	1	2	1	1	-	2	-	-	-	-	2	2

Course Code	**MPHR 310**			
Course Title	**PROTECTED CULTIVATION AND SECONDARY AGRICULTURE**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	28			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on production technology of crops under controlled greenhouse condition with respected to temperature (maximum and minimum) , relative humidity and air pressure.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn the technology of growing crop plants under controlled greenhouse condition
- Learn Greenhouse technology: Types of Greenhouses; Plant response to greenhouse environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes
- Know greenhouse equipmentand materials of construction for traditional and low cost greenhouses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air greenhouse heating systems, green house drying
- Understand important engineering properties such as physical, thermal and aero and hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.
- Follow the drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer),material handling equipment, conveyer and elevators, their principle, working and selection.

Course content

UNIT– I **07 Hours**

- Importance and scope of ornamental crops,
- Green house technology: Introduction, types of Greenhouses
- Plant response to greenhouse environment, planning and design of greenhouses, Design criteria of green house for cooling and heating purposes.
- Green house equipment, materials of construction for traditional and low cost greenhouses.
- Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis.

UNIT II **07 Hours**

- Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.
- Drying and dehydration;
- Moisture measurement, EMC, drying theory, various drying method,
- Commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer).
- Material handling equipment; conveyer and elevators, their principle, working and selection.

PRACTICAL

UNIT-III **07 Hours**

- Study of different type of greenhouses based on shape.
- Determine the rate of air exchange in an active summer winter cooling system.
- Determination of drying rate of agricultural products inside green house.
- Study of greenhouse equipment.
- Air conditioning, cooling, airflow, temperature control etc

UNIT-IV07 Hours

- Visit to various Post Harvest Laboratories.
- Determination of Moisture content of various grains by oven drying & infrared moisture methods
- Determination of engineering properties (shape and size, bulk density and porosity of biomaterials)
- Determination of Moisture content of various grains by moisture meter.
- Field visit to seed processing plant.

Recommended Books:(LatestEditions)

- NathP:AgricultureandFoodTechnologyinHumanLife, Scientific Publishers
- ShekhawatSS:Chickpea(Gram)StatusandCultivation, Technology, ICAR, New Delhi

Reference Books

- NairB:FundamentalsofVegetableCropProduction, Scientific Publishers
- Nath A : PostHarvestManagement and Production ofImportantHorticulturalCrops, Scientific Publishers
- SharmaAD:PostharvestTechnologyofKinnow, Scientific Publishers
- AsieduJJ:ProcessingTropicalCropsATechnologicalApproach, Scientific Publishers, India

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
MPHR 310.1	2	3	3	-	-	-	-	-	1	-	-	2
MPHR 310.2	3	1	3	3	-	2	-	2	-	2	3	2
MPHR 310.3	3	3	2	3	4	1	2	2	-	2	2	-
MPHR 310.4		3	2	2	2	3	1	1	2	-	1	-
MPHR 310.5	1	2	1	1	-	2	-	-	-	-	2	-

ELECTIVE COURSES

Course Code	**EC 311**			
Course Title	**AGROMET ADVISORY SERVICES AND CROP MODELLING**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on preparation of weather-based agro-advisories based on weather forecast via-a-vis weather calendar for principal crops

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand weather forecasting system: definition, scope and importance; forecasting problems; classified terminology of weather parameters used in weather forecasts and their interpretation.
- Know elements of agricultural weather forecasts, types of forecasting: short, medium and long-range, study of synoptic charts with special reference to location of highs and lows, thunderstorm prediction, interpretation of satellite pictures of clouds in visible and infra-red range.
- Understand special forecasts for natural calamities such as drought, floods, high winds, cold (frost) and heat waves, hail storms, cyclones and protection measures against such hazards; weather based advisories: concept of agrometeorological advisory; preparation of weather-based advisories for farmers and dissemination; verification of weather forecasts.

- Learn application of crop modeling, types of models, concepts of mechanistic and deterministic models,empirical and statistical crop weather models and their application with examples, regression models-incorporating weather, soil, plant and other environmental related parameters and remote sensing inputs, growth and yield prediction models, general features of dynamic and statistical modeling techniques.

- Understand crop simulation models, e.g. CERES, Oryza, InfoCrop, etc, use of crop simulation model in determining climatic change impact on agriculture, verification, calibration and validation of models.

CourseContent

UNIT– I **06 Hours**

- Weather forecasting system: definition, scope and importance; forecasting problems
- Classified terminology of weather parameters used in weather forecasts and their interpretation
- Elements of agricultural weather forecasts.
- Types of forecasting: short, medium and long-range; study of synoptic charts with special reference to location of highs and lows,
- Thunderstorm prediction; interpretation of satellite pictures of clouds in visible and infra-red range.

UNIT-II **06 Hours**

- Special forecasts: special forecasts for natural calamities such as drought, floods, high winds, cold (frost) and heat waves, hail storms, cyclones and protection measures against such hazards;
- Weather based advisories.
- Concept of agrometeorological advisory; preparation of weather-based advisories for farmers and dissemination; verification of weather forecasts
- Principles of crop production; evaluation of crop responses to weather elements.
- Introduction and application of crop modeling, types of models, concepts of mechanistic and deterministic models;

UNIT-III **06 Hours**

- Empirical and statistical crop weather models and their application with examples.
- Regression models-incorporating weather, soil, plant and other environmental related parameters and remote sensing inputs; growth and yield prediction models; general features of dynamic and statistical modeling techniques
- Dynamic crop simulation models, e.g. CERES, Oryza, InfoCrop, etc.;
- Use of crop simulation model in determining climatic change impact on agriculture
- Verification, calibration and validation of models.

PRACTICALS

UNIT IV **06Hours**

- Preparation of weather-based agro-advisories based on weather forecast.
- Preparation of crop- weather calendar for principal crops.
- Verification of medium range weather forecasts and analysis of feedback from farmers receiving AAS bulletins.
- Working with statistical and simulation models.
- To develop linear regression models involving weather data and yield of principal crops.

UNIT V **06 Hours**

- To develop nonlinear regression models involving weather data and yield of principal crops.
- To determine the impact of elevated temperature scenarios on principal crops
- Preparation of contingent crop planning schedule
- Forecasting early, mid-season and terminal droughts in dryland areas

Recommended Books:(LatestEditions)

- FAO:Climate-SmartAgricultureSourceBook, FAO, Rome.

- SundaresanJ:ClimateChangeandEnvironment, Scientific Publishers
- MohantyM:CropGrowthSimulationModellingandClimateChange, Scientific Publishers.
- NiggliURS:OrganicAgricultureandClimateChangeMitigation, Scientific Publishers
- Mote BM:Principles of Agricultural Meteorology, Scientific Publishers

Reference Books

- PatelAN:RemoteSensing:PrinciplesandApplication2ndEd. Scientific Publishers.
- GaurM:RemoteSensingforNaturalResourcesManagement&Monitoring, ICAR, New Delhi
- SehgalVK:ClimateAgricultureandManShrinkingBiodiversityandsustainability, Scientific Publishers
- ChouhanTS:CombatingDesertificationLandDegra-dationandClimateChange:ManagementofDryLands, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 311.1	2	3	3	-	2	-	-	-	1	2	-	2
EC 311.2	3	1	3	3	-	2	-	2	-	2	3	-
EC 311.3	3	-	2	3	2	1	2	2	-	-	2	-
EC 311.4	3	3	2	2	-	3	1	1	2	-	1	2
EC 311.5	1	2	1	1	-	-	2	-	-	-	2	-

Course Code	**EC 312**
Course Title	**WATERSHED AND WETLAND MANAGEMENT**

Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on selection criteria and methods of identification of watershed,steps, procedure and planning of watershed management andWetland management for livestock production.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand selection criteria and methods of identification of watershed; steps, procedure and planning of watershed management,watershed hydrology, rainfall-runoffrelationship.
- Visualize Case studies of some identified watershed and their management under different agro-climatic situation, Selection of different conservation treatment and production systems and their use in watershed management
- Develop economically and ecologically sustainable agro-forestry systems for watershed; Wetlands: definition, distribution; types, classification, ecology, functions, attributes and values.
- Learn Wetland rules in India; Agriculture in wetland resources: improvised methodological approaches and aquatic crops (food, food-cum-ornamental, non-food commercial, medicinal plants etc.);
- Know Wetland management for livestock production: principles and management practices, integration with fish culture and agriculture for sustainable use.

Course content

UNIT– I **06 Hours**

- Delineation of watershed; Watershed Atlas of India; Selection criteria and methods of identification of watershed
- Steps, procedure and planning of watershed management; Watershed hydrology, rainfall-runoff relationship
- Case studies of some identified watershed and their management under different agro-climatic situation
- Selection of different conservation treatment and production systems and their use in

watershed management

- Developing economically and ecologically sustainable agro-forestry systems for watershed

UNIT-II **06 Hours**

- Wetlands: definition, distribution; types, classification, ecology, functions, attributes and values
- Wetland rules in India
- Agriculture in wetland resources: improvised methodological approaches and aquatic crops (food, food-cum-ornamental, non-food commercial, medicinal plants etc.);
- Wetland management for livestock production
- Principles and management practices, integration with fish culture and agriculture for sustainable use

UNIT-III **06 Hours**

- Wetland management for fish culture.
- Principles and practices of aquaculture with special reference to wetland utilization.
- Threats to wetlands: climate change and human use.
- Impact of industrialization, conservation, protection, and restoration and challenges.
- Livelihood development and impacts of agriculture on wetlands.

PRACTICALS

UNIT IV **06Hours**

- Study on watershed atlas of India.
- Delineation of watershed;
- Rainfall analysis–frequency, intensity, duration and probability;
- Analysis of rainfall-runoff relationship;
- Case studies of a few identified watersheds – their management under different agro-climatic situations;

UNIT V **06 Hours**

- Wetland morphometry, Analysis and identification of abiotic (physico-chemical properties of water) and
- Biotic components (aquatic plants, phytoplankton, zooplankton and benthic invertebrates) of wetlands;
- Study on different types of livestock production systems in wetlands; Identification of some culturable fish and prawn species;
- Visit different types of models for aquatic crops and integrated fish farming in wetlands

Recommended Books:(LatestEditions)

- Reddy S R and Prabhakara Reddy G: Rainfed Agriculture and Watershed Management , Kalyani Publications

Reference Books

- Wei J:Wetland and Water Resource Modelling and Assessment: A Watershed Perspective (Integrative Studies in Water Management and Land Development), CRC Press
- Ali Fares and Aly I. El-Kadi : Coastal Watershed Management ,WIT Press, Southampton, UK
- Brooks KN: Hydrology and Management of Watershed, Wiley and Blackwel

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 312.1	3	3	3	-	-	-	-	-	1	-	-	2
EC 312.2	2	1	3	2	2	2	-	2	-	2	3	2
EC 312.3	2	-	2	3	2	1	2	2	-	2	2	1
EC 312.4	3	3	2	3	3	3	1	1	2	-	1	-
EC 312.5	1	2	1	1	-	-	2	-	-	-	2	-

Course Code	**EC 313**			
Course Title	**WEED MANAGEMENT**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3

Total Contact Hours	35
Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on classification, characteristics, reproduction and dissemination of weeds,crop-weed association / competition,harmful and beneficial effects of weeds, and their utilization

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand Classification, characteristics, reproduction and dissemination of weeds,crop-weed association / competition,
- Understand harmful and beneficial effects of weeds, and their utilization,survey and surveillance of weeds including invasive ones
- Know the status, advantages and limitations of usage of herbicides in India; Chemical weed management, herbicides, classification, selectivity, resistance, mixtures, compatibility with other agro-chemicals
- Learn concept of formulations, and use of adjuvants, safeners and surfactants; Concept and application of integrated weed management for major field crops,weed management for important cropping systems.
- Learn eco-safe weed management by cultural and mechanical methods,biological methods,
  bio-agents, bio-herbicides and allelopathy in weed management

Course content

UNIT– I **06Hours**

- Classification, characteristics, reproduction and dissemination of weeds
- Crop-weed association / competition and weed seed bank
- Harmful and beneficial effects of weeds, and their utilization
- Survey and surveillance of weeds including invasive ones
- Eco-safe weed management by cultural and mechanical methods

UNIT-II **06 Hours**

- Wetlands: definition, distribution; types, classification, ecology, functions, attributes and values
- Biological methods, bio-agents, bio-herbicides and allelopathy in weed management
- Status, advantages and limitations of usage of herbicides in India
- Chemical weed management, herbicides
- classification

UNIT-III **06 Hours**

- Wetland management for fish culture.
- Selectivity, resistance, mixtures, compatibility with other agro-chemicals
- Concept of formulations, and use of adjuvants, safeners and surfactants
- Concept and application of integrated weed management for major field crops
- Weed management for important cropping systems

PRACTICALS

UNIT IV **06 Hours**

- Identification of weed flora in various ecological situations and cropping systems
- Study on crop-weed competition and weed seed bank
- Techniques of weed preservation
- Preparation of weed herbarium
- Study on bio-efficacy and phyto-toxicity

UNIT V **06 Hours**

- Symptoms of herbicides in different crops
- Computation of herbicide doses and demonstration of application methods
- Calculation on weed index and weed control efficiency
- Preparation and application of bio-herbicides
- Weed utilization as compost (Parthenium, Water hyacinth, Cassia, etc.)

Recommended Books:(LatestEditions)

- Reddy S R and Ramu Reddy Y:Agronomy of Field Crops, Kalyani Publications, New Delhi
- Singh S S and Singh R: Crop Management under Irrigated & Rainfed Condition, , Kalyani Publications,New Delhi
- Das N R:IntroductiontoCropsofIndia.2nd Edition, Kalyani Publications

Reference Books

- Joseph A: AgroforestryTheoryandPractices, ICAR, New Delhi
- Walia US:CropManagement, 2nd Edition, Scientific Publishers
- Jat M L:DrylandTechnology,2ndEd. ICAR, New Delhi
- JainL K:ManualonFundamentalsofAgronomy, ICAR, New Delhi
- Das NR:PracticalManualonBasicAgronomy(WithTheory)(2ndEdition), Scientific Publishers
- Walia US:ScienceofAgronomy, Scientific Publishers
- Arya RL:FundamentalsofAgronomy, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 313.1	2	3	3	-	-	-	-	-	1	-	-	2
EC 313.2	3	1	3	3	2	2	-	2	-	-	3	2
EC 313.3	3	-	2	3	2	1	2	2	-	-	2	2
EC 313.4	3	3	2	2	-	3	1	1	2	-	1	
EC 313.5	1	2	1	1	2	-	2	-	-	-	2	

Course Code	**EC 314**			
Course Title	**DETECTION AND DIAGNOSIS OF PLANT DISEASES**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			

Pre-requisites	None

Scope: This course is designed to impart a comprehensive knowledge on diagnosis of plant diseases and a balance of nature- natural control, biological control, its advantages and disadvantages.

Objectives: Upon completion of this course the student should be able to:

- Have a comprehensive outlook on diagnosis of plant diseases and a balance of nature-natural control, biological control, its advantages and disadvantages
- Understand biocontrol agents - insects, arachnids, nematodes, fungi, bacteria, viruses, protozoa, vertebrates.
- Know parasitoids and predators- types of parasitism, methods of biological control-conservation, augmentation and importation.
- Learn about predators and parasitoids of agricultural importance
- Feel the necessity of Mass Production of bio control agents.

Course content

UNIT– I **06 Hours**

- Balance of nature- natural control.
- Biological control- definition, its advantages and disadvantages.
- Biocontrol agents - insects, arachnids, nematodes, fungi, bacteria, viruses, protozoa, Vertebrates.
- Brief history of bio-control with examples of successful cases
- .Insects parasitoids and predators- types of parasitism.

UNIT-II **06 Hours**

- Methods of biological control- conservation, augmentation and importation
- .Predators and parasitoids of agricultural importance
- Coleoptera(Coccinellids, Carabids, Staphylinids);
- Neuroptra (chrysopids); Hemiptra (Mirids, Reduviids, Pentatomids);
- Diptra(Syrphids, Tachinids);

UNIT-III **06 Hours**

- Wetland management for fish culture.
- Lepidoptra (Pyralid- Epiricaniamelanolenca);
- Hymenoptra (Trichogranmatids, Eulophids, Scelionids, Mymarids, Braconids, Ichneumonids);
- Spiders (Arachina); Mites (Phytoseiids)
- Weed feeding herbivores-Zygogrammabicolorala.

UNIT IV **06Hours**

- Bio-pesticides - Entomopathogenic microbes,
- Bacteria - *Bascillusthuringensis*, *Bpopillae*;
- Fungi - (*Beauveriabassiana*, *Metarhiziumanisopliae*, *Verticiliumlecanii*, *Nomuraearileyi*, Viruses (NPV and GV);
- Nematodes (Heterohabidity idea, Steinemematidae
- Protozoa,Mass production of bio control agents.

PRACTICAL

UNIT V **06 Hours**

- Mass rearing of natural enemies- facilities required in general for mass production of natural enemies.
- Mass rearing of host insects of natural enemies on nature or artificial diets. a) *Corcyra cephalonica*, b) *Spodopteralitura*, c) *Plutellaxylostella*d) *Helicoverpaarmigera*, e) Mealy bugs, f) *Galleria mellonella*.

- Mass production of parasitoids and predators.-. a) *Trichogrammachilonis / T. japonicum,* b) *Braconbrevicornis*c) *Cotesiaplutellae,* d) *Chrysoperlacarnea* e) *Cryptolaemusmontrouzieri*, f) *Scymnuscoccivora*
- .Mass production of weed feeding herbivore- *Zygogranmabicolorata.*Quality control of natural enemies.
- Impact assessment of natural enemies.

Recommended Books:(LatestEditions)

- DubeHC:AnIntroductiontoFungi,4thEd., Scientific Publishers
- BajajHK:HandbookofPracticalNematology, Scientific Publishers

Reference Books

- Reddy PP:TextBookofIntroductoryPlant Nematology, Scientific Publishers, India
- GourHN:AnnualReviewofPlantPathology(1-6), Springer Nature

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 314.1	3	3	3	-	-	-	-	-	1	-	-	
EC 314.2	2	1	3	3	-	2	-	2	-	-	3	
EC 314.3	3	-	3	3	-	1	2	2	-	-	2	
EC 314.4	3	3	2	2	-	3	1	1	2	-	1	
EC 314.5	1	2	1	1	-	-	2	-	-	-	2	

Course Code	**EC 315**			
Course Title	**PLANT DEVELOPMENTAL BIOLOGY**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3

Total Contact Hours	30
Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on plant growth, development and differentiation: embryogenesis and its different stages,meristems in plant development

Objectives: Upon completionofthiscoursethestudentshouldbeableto

- Understand plant growth, development and differentiation: Embryogenesis and its different stages,meristems in plant development, Homeobox genes, Development of root, shoot and floral primordia, cell differentiation and its control, cell-cell interaction.
- Learn Reproductive biology: Alternation of generation, sporogenesis and gametogenesis, pollination and fertilization in flowering plants.Introduction of photoperiodism and vernalization, photoperiodic induction, phytochrome structure, molecular basis of floral induction and floral organ development.
- Understand response of plants to adverse abiotic factors: Plants' responses to drought, salinity, heat, cold, flood, heavy metals and nutritional deficiency and toxicity.
- Learn tolerance mechanism of plants to various abiotic stresses, introduction to osmolytes, oxidative stress and antioxidative mechanisms, heat shock proteins.
- Learn the relationship between phytohormones and plant growth: physiological roles and mode of action of auxin, gibberellins, cytokinins, ethylene and ABA.Novel plant growth regulators- physiological roles of salicylic acid, brassinosteroids, jasmonic acid, polyamines.

Course content

UNIT– I **06 Hours**

- Plant growth, development and differentiation
- Embryogenesis and its different stages,
- Meristems in plant development, Homeobox genes,
- Development of root, shoot and floral primordia,
- Cell differentiation and its control, cell-cell interaction.

UNIT-II **06 Hour**

- Reproductive biology
- Alternation of generation, sporogenesis and gametogenesis, pollination and fertilization in flowering plants.
- Introduction of photoperiodism and vernalization,
- photoperiodic induction,
- Phytochrome structure, molecular basis of floral induction and floral organ development.

UNIT-III **06 Hours**

- Reproductive biology: Alternation of generation, sporogenesis and gametogenesis, pollination and fertilization in flowering plants.
- Introduction of photoperiodism and vernalization, photoperiodic induction, phytochrome structure,
- Molecular basis of floral induction and floral organ development.
- Response of plants to adverse abiotic factors
- Plants' responses to drought, salinity, heat, cold, flood, heavy metals and nutritional deficiency and toxicity.

UNIT IV **06Hours**

- Tolerance mechanism of plants to various abiotic stresses, introduction to osmolytes, oxidative stress and antioxidative mechanisms, heat shock proteins.

- Phytohormones and plant growth,physiological roles and mode of action of auxin, gibberellins, cytokinins, ethylene and ABA.
- Novel plant growth regulators- physiological roles of salicylic acid, brassinosteroids, jasmonic acid, polyamines.
- Applied plant physiology: Factors controlling photosynthetic productivity,
- partitioninig of photosynthate and its regulation, senescence and fruit ripening,
- Soil-less culture and its application to diagnose nutrient deficiencies

PRACTICAL

UNIT V **06 Hours**

- Effect of gibberellic acid on dormancy breaking, seed germination and mobilization of food reserves
- Effect of ABA on stomatal opening and closing;Effect of ethylene on fruit ripening; Bioassay of different phytohormones
- Study of pollen sterility; Study of pollen germination and pollen tube growth
- Response of plant to abiotic stress in relation to seed germination and early seedling growth; Estimation of proline; Determination of membrane damage
- Determination of the activity of antioxidative enzymes (peroxidase and catalase); Study of growth indices
- Preparation of Hoagland solution; Soil-less cultivation of plants and diagnosis of nutritional disorders.

Recommended Books:(LatestEditions)

- Pandey S N, Misra S P and Trivedi P S: A Text Book of Botany, Vikas Publishing House
- Arumugan N, Ragland A and Kumaresan V: A Text Book of Botany, Saras

Publications

Reference Books

- Lars H and Claudia K:Plant Developmental Biology- Methods and Protocols, Springer Science
- Quentin C B, Richard M Batman J and Hawkins A: Developmental Genetics and Plant Evolution, CRC Press
- Howell S H: Molecular Genetics of Plant Development, Taylor & Francis

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 315.1	3	3	3	-	-	-	-	-	1	-	-	2
EC 315.2	2	1	3	3	2	2	-	2	-	-	3	2
EC 315.3	3	-	3	3	-	1	2	2	-	-	2	2
EC 315.4	3	3	2	2	2	3	1	1	2	-	1	1
EC 315.5	1	2	1	1	-	-	2	-	-	-	2	-

Course Code	**EC 316**
Course Title	**QUALITY CONTROL OF SEEDS**
Category	

LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	32			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on quality of seeds on the basis of physiological, biological and physical parameters

Objectives: Upon completionofthiscoursethestudentshouldbeableto

- Understand Concept of seed quality, components of seed quality, role of ISTA, CSTL,SSTL, SCA
- Know purity of seeds,types of purity, definition, components, methods for genetic and physical purity analysis, calculation, seed purity standard,
- Learn seed germination: definition, types of germination, requirements for germination test, testing procedure, first count and final count.
- Learn viability analysis: concept on viability, importance, different tests for seed viability, preparation of solutions and evaluation procedures in TZ test.
- Seed certification: concept, seed certification agency, seed certification standards, certification steps, power and duties of seed inspector,

Course content

UNIT– I **07Hours**

- Concept on seed quality: Concept, components of seed quality, role of ISTA, CSTL,SSTL, SCA
- Seed Sampling: Concept and steps of seed sampling, sampling intensity, sampling techniques, precautions, sampling devices, Weight of the different samples
- Purity of Seed Lot: Types of purity, Definition, components, methods for genetic and physical purity analysis, calculation, seed purity standard
- Seed Moisture content: Objective, Equilibrium moisture content, methods for moisture determination, calculation.

- Seed Germination: Definition, Types of germination, requirements for germination test, testing procedure, first count and final count.

UNIT-II **07 Hour**

- Viability analysis: Concept on viability, importance, different tests for seed viability, preparation of solutions and evaluation procedures in TZ test.
- Seed vigour : Concept, importance, factors, different tests for seed vigour.
- Seed Health: Concept, Test procedures,
- Seed Certification: Concept, seed certification agency, seed certification standards, certification steps, power and duties of seed inspector,
- Seed Treatment: Importance, types, methods, equipment for seed treatmen

PRACTICAL

UNIT-III **07 Hours**

- Identification of different crop and weed seed.
- Identification of different instruments and machineries available in Seed Testing Lab.
- Determination of physical purity of seed sample.
- Cultivar purity test.
- Determination of seed moisture content.

UNIT IV **07 Hours**

- Determination of seed viability of different crops.
- Determination of germination potential of different seeds.
- Determination of seed vigour through different methods.
- Study on seed production of different crops.
- Observation on operation of seed processing plant.
- Visit to seed testing laboratory.

Recommended Books:(LatestEditions)

- OakleyPO:GuidetoExtensionTraining, ICAR, New Delhi
- SinghAK:PioneerResearchinExtensionEducation, Scientific Publishers

Reference Book

- CholeRR:TransferofAgriculturalTechnology, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 317.1	3	3	3	-	-	-	-	-	1	-	-	2
EC 317.2	2	1	3	3	-	2	-	2	-	-	3	2
EC 317.3	3	-	3	3	-	1	2	2	-	-	2	-
EC 317.4	3	3	2	2	-	3	1	1	2	-	1	-
EC 317.5	1	2	1	1	-	-	2	-	-	-	2	1

Course Code	EC 318			
Course Title	STATISTICAL METHODS I			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3

Total Contact Hours	30
Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on basic principles, parameters and application of statistics.

Objectives: Upon completionofthiscoursethestudentshouldbeableto

- Understand the Descriptive statistics: Probability and probability distributions, Discrete probability distributions and Properties of these distributions. Continuous probability distributions and Properties of these distributions
- Learn Pearsonian curves and its various types. sampling distributions of sample mean and sample variance from Normal Population, Central and non–central chi-Square, *t* and *F* distributions, their properties and inter relationships.
- Know Correlation, rank correlation, correlation ratio and intra-class correlation.Regression analysis, partial and multiple correlation and regressionMethod of estimation of Parameters, Multicollinearity, Auto- Correlation.
- Matrix and Vector Algebra. Coordinate Geometry in two dimensions. Beta and Gamma Functions, Double integral, Differential equations, Interpolations, Infinite series, Numerical differentiation and integration. Newton and Raphson
- Functional units of computer, I/O devices, primary and secondary memories.
  Programming Fundamentals with C - Algorithm, techniques of problem solving, flowcharting, stepwise refinement; Representation of integer, character, real, data types; Constants and variables; Arithmetic expressions, assignment statement, logical expression.

.

Course content

UNIT– I **06Hours**

- History of extension education in IndiaHistory of extension education inIndia
- Descriptive statistics: probability and probability distributions
- Discrete probability distributions and Properties of these distributions.
- Continuous probability distributions and Properties of these distributions.
- Pearsonian curves and its various types.

UNIT-II **06 Hours**

- Sampling distributions of sample mean and sample variance from Normal population,
- Central and non–central chi-Square, *t* and *F* distributions, their properties and inter relationships.
- Correlation, rank correlation, correlation ratio and intra-class correlation.
- Regression analysis, partial and multiple correlation and regression
- Method of estimation of Parameters, Multicollinearity, Auto- Correlation

UNIT-III **06 Hours**

- PERT, CPM, GART Concept,
- Principle and Application, Gantt chart in project management.
- Matrix and Vector Algebra. Coordinate Geometry in two dimensions.
- Beta and Gamma Functions, Double integral,
- Differential equations, Interpolations, Infinite series,

UNIT IV **06 Hours**

- Functional units of computer, I/O devices
- Primary and secondary memories.

- Programming Fundamentals with C - Algorithm,
- Ttechniques of problem solving, flowcharting, stepwise refinement;
- Representation of integer, character, real, data types;
- Constants and variables; Arithmetic expressions, assignment statement, logical expression.

PRACTICALS

UNIT V **06 Hours**

All the above topics will be covered in practiced

Recommended Books:(LatestEditions)

- Rangaswamy R :A Textbook of Agricultural Statistics (3 rd Edition New Age International Publishers

Reference Books

- Dhamu K P :Fundamentals of Agricultural Statistics Scientific Publishers
- Rout R K and Das LK: A Textbook of Basic Agricultural Statistics Kalyani Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 318.1	3	3	3	-	-	-	-	-	1	-	-	
EC 318.2	2	1	3	3	-	2	-	2	-	-	3	
EC 318.3	3	-	3	3	-	1	2	2	-	-	2	
EC 318.4	3	3	2	2	-	3	1	1	2	-	1	
EC 318.5	1	2	1	1	-	-	2	-	-	-	2	

SEMESTER VI

Course Code	AGR 351

Course Title	PRINCIPLES OF ORGANIC FARMING			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge organic farming where no chemicals as fertilizers and pesticides will be used to produce crops.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn Organic farming: principles, status and its scope in India,initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture
- Understand Organic ecosystem and their concept,oganic nutrient resources and its fortification; restrictions to nutrient use in organic farming,
- Appreciate choice of crops and varieties in organic farming,fundamentals of insect, pest, disease and weed management under organic mode of production
- Know operational structure of NPOP; Certification process and standards of organic farming
- Understand processing, labeling, marketing and export potential of organic products, and economic considerations and viability.

Course content

UNIT– I **08 Hours**

- Organic farming: principles, status and its scope in India
- Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture
- Organic ecosystem and their concepts
- Organic nutrient resources and its fortification

- Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, labeling, marketing and export potential of organic products, and economic considerations and viability.

UNIT II **08 Hours**

- Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design
- Choice of crops and varieties in organic farming;
- Fundamentals of insect, pest, disease and weed management under organic mode of production;
- Operational structure of NPOP;
- Certification process and standards of organic farming; Processing, labeling, marketing and export potential of organic products, and economic considerations and viability.

PRACTICAL

UNIT III **08 Hours**

- Visit of organic farms to study the various components and their utilization;
- Preparation of enrich compost, vermicompost, bio-fertilizers / bio-inoculants, their quality analyses and applications;
- Use of green manures;
- Raising of high-value crops under organic production system;
- Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management;
- Cost of organic production system; Post harvest management; grading, packaging,

handling and quality aspect.

Recommended Books:(LatestEditions)

- PalaniappanSP:OrganicFarming–TheoryandPractice, Scientific Publishers
- TarafdarJC.:OrganicAgriculture., Scientific Publishers
- Walia,U.S:CropManagement, Kalyani Publishers

Reference Books

- Narain,P:DiversificationofAridFarmingSystems, Kalyani Publications
- Joshi,M:NewVistasofOrganicFarming,2ndEd., Scientific Publishers
- Niggli,URS:OrganicAgricultureandClimateChangeMitigation,International Trade Centre UNCTAD/WTO, Palais des Nations, 1211 Geneva 10, Switzerland.
- Hansen,A.L:TheOrganicFarmingManual,Storey Publishing, LLC

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AGR 351.1	2	3	3	-	-	-	-	-	1	-	-	2
AGR 351.2		1	3	3	-	2	-	2	-	-	3	2
AGR 351.3	3	3	2	3	4	1	2	2	-	-	2	-
AGR 351.4		3	2	2	2	3	1	1	2	-	1	-
AGR 351.5	1	2	1	1	-	2	-	-	-	-	2	-

Course Code	**AGR 352**			
Course Title	**FARMING SYSTEM AND SUSTAINABLE AGRICULTURE**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2

Total Contact Hours	24
Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on sustainable crop production alone or under Integrated Farming System using multiple crop management.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the nature, scope, importance of sustainability without deterioration
- Learn Farming system components and their maintenance; Cropping system and pattern, multiple cropping, efficient cropping system and their evaluation, allied enterprises and their importance
- Know the tools for determining production and efficiencies in sustainable cropping and farming system
- Understandresource-use-efficiency and optimization techniques, resource cycling and flow of energy in different farming system

Course content

UNIT– I **06Hours**

- Importance and scope of ornamental crops
- Farming System: scope, importance and concept
- Types of farming system and influential factors
- Farming system components and their maintenance
- Cropping system and pattern, multiple cropping,
- Eficient cropping system and their evaluation, allied enterprises and their importance;

UNIT II **06 Hours**

- Tools for determining production and efficiencies in cropping and farming system;

- Integrated Farming System (IFS): historical background, objectives, characteristics, components and advantages.
- Site-specific development of IFS model for different agro-climatic zones.
- Resource-use-efficiency and optimization techniques,
- Resource cycling and flow of energy in different farming system

UNIT-III **06 Hours**

- Farming system and environment;
- Sustainable agriculture: concept and impact on agriculture,
- Indicators of sustainabilityadaptation and mitigation
- Conservation agriculture strategies in agriculture, techniques for sustainability of HEIA, LEIA and LEISA.
- Economics of such a sustainable crop production

PRACTICAL

UNIT-IV

06 Hours

- Visit to various Post Harvest Laboratories.
- Preparation of cropping scheme for irrigated and dryland situations;
- Preparation of integrated farming system model for wetlands and drylands;
- Calculations on yield advantage and efficiency of cropping and farming systems;
- Preparation of map showing different cropping systems for different districts / agro-climatic zones of West Bengal
- Visit of IFS models at University and farmers' fields in different agro-climatic zones; Study on indicators of sustainability;
- Cultivation practices for conservation agriculture.

Recommended Books:(LatestEditions)

- Palaniappan,S.P.OrganicFarming-TheoryandPractice, Scientific Publishers

- WaliaU.S:CropManagement, Scientific Publishers
- NarainP:DiversificationofAridFarmingSystems, Scientific Publishers

Reference Books

- JoshiBM:NewVistasofOrganicFarming,2ndEd., Scientific Publishers
- SinghRP:SustainableDevelopmentofDrylandAgricultureinIndia, Scientific Publishers
- MeenaRS:SustainableAgriculture, ICAR, New Delhi
- HaniFJ:SustainableAgriculture:FromCommonPrinciplesto commonpractice, IISD, Berns, Switzerlands

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AGR 352.1	2	3	3	-	-	-	-	-	1	-	-	2
AGR 352.2		1	3	3	-	2	-	2	-	-	3	-
AGR 352.3	3	3	2	3	4	1	2	2	-	-	2	2
AGR 352.4		3	2	2	2	3	1	1	2	-	1	-
AGR 352.5	1	2	1	1	-	2	-	-	-	-	2	2

Course Code	**GPB 353**			
Course Title	**INTELLECTUAL PROPERTY RIFGTS**			
Category				
LTP & Credits	L	T	P	Credits
	1		0	1
Total Contact Hours	12			

Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on Intellectual Property Rights, the properties, history, concept and introduction to GATT, WTO, TRIPs and WIPO; Treaties for IPR protection.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the properties, meaning, concept and scope , and jurisdiction of Intellectual Property Rights
- Understand the types of intellectual property and legislations related to IPR in India: Patents, Copyrights, Trademark, Industrial design, Geographical indication, Integrated circuits, Trade secrets
- Understand Patents Act 1970 and patent system in India: patentability, process and product patent, filing of patent, patent specification, patent claims, patent opposition and revocation, infringement, compulsory licensing, Patent Co-operation Treaty, patent search and patent database
- Know the origin, history and introduction to UPOV for protection of plant varieties; PPV&FR Act 2001
- Know the Convention on biological diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA), Indian Biological Diversity Act, 2002,salient features, access and benefit sharing.

Course content

UNIT– I **04Hours**

- Intellectual property: history and concept
- Brief introduction to GATT, WTO, TRIPs and WIPO; Treaties for IPR protection
- Madrid protocol, Berne convention, Budapest treaty, etc
- Types of intellectual property and legislations related to IPR in India
- Patents, Copyrights, Trademark, Industrial design, Geographical indication

UNIT II **04 Hours**

- Integrated circuits, Trade secrets, Patents Act 1970 and patent system in India
- Patentability, process and product patent, filing of patent, patent specification, patent claims, patent opposition and revocation, infringement, compulsory licensing
- Patent Co-operation Treaty, patent search and patent database; Origin, history and introduction to UPOV for protection of plant varieties
- PPV&FR Act 2001: origin, structure and chapters, rights of breeders, researcher and farmers,
- Registration of plant varieties and genome saviour awards

UNIT III **04 Hours**

- Traditional knowledge and rights of TK holders
- Convention on biological diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA);
- Indian Biological Diversity Act, 2002:
- Salient features, access and benefit sharing.

Recommended Books:(LatestEditions)

- Pandey N and Khushdeep D:Intellectual Property Rights, PHI Learning Pvt Ptd
- Ahuja, K K: Intellectual Property Rights in India, Lexis Nexis.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
GPB 353.1	2	3	3	-	-	-	-	-	1	-	-	
GPB 353.2		1	3	3	-	2	-	2	-	-	3	
GPB 353.3	3	3	2	3	4	1	2	2	-	-	2	
GPB 353.4		3	2	2	2	3	1	1	2	-	1	
GPB 353.5	1	2	1	1	-	2	-	-	-	-	2	

Course Code	**AEN 354**			
Course Title	**MANAGEMENT OF BENEFICIAL INSECTS**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			

Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on beneficial insects viz. honey bee, silk worm, butterfly, lac insect and pollinators and their biology.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn the importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease.
- Know about Bee pasturage, bee foraging and communication.Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.
- Know about ypes of silkworm, voltinism and biology of silkworm.Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.
- Understand rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection
- Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological contro

Course content

UNIT– I **06Hours**

- Importance of beneficial Insects, Beekeeping and pollinators
- Bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease.
- Bee pasturage, bee foraging and communication.Insect pests and diseases of honey bee.
- Role of pollinators in cross pollinated plants.
- Types of silkworm, voltinism and biology of silkworm

UNIT II **06 Hours**

- Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.
- Rearing, mounting and harvesting of cocoons.
- Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.
- Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products.
- Identification of major parasitoids and predators commonly being used in biological control.

UNIT III **06 Hours**

- Traditional knowledge and rights of TK holders
- Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques.
- Important species of pollinator, weed killers and scavengers with their importance
- Honey bee species, castes of bees.
- Beekeeping appliances and seasonal management, bee enemies and disease.

UNIT IV **06 Hours**

- Beekeeping appliances and seasonal management, bee enemies and disease
- Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.

Recommended Books:(LatestEditions)

- TrigunayatMM:AManualofPracticalEntomology,3rdEd., Scientific Publishers.
- AwasthiVB:PrinciplesofInsectBehaviour,2ndEd. Scientific Publishers

Reference Books

- TyagiB.K:EntomologyEcologyandBiodiversity, Kalyani Publications
- Ananthakrishnan,T.N.:InsectBiodiversity-

FunctionalDynamicsandEcologicalPerspectives, Scientific Publishers

- AbrolDP:Beekeeping:AConciseGuidetoBeesandBeekeeping, ICAR, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AEN 354.1	2	3	3	-	-	-	-	-	1	-	-	-
AEN 354.2	2	1	3	3	-	2	-	2	-	-	3	2
AEN 354.3	3	2	2	3	4	1	2	2	-	-	2	1
AEN 354.4	3	3	2	2	2	3	1	1	2	-	1	-
AEN 354.5	1	2	1	1	-	2	-	-	-	-	2	-

Course Code	**AGMP 355**			
Course Title	**GEO-INFORMATICS AND NANOTECHNOLOGY FOR PRECISION FARMING**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamental knowledge on Precision agriculture its concept, techniques, issues and concerns for Indian agriculture

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn the role of Precision Agriculture, concept, techniques, issues and concerns for Indian agriculture
- Know about Nanotechnology: definition, concept and techniques,Nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, etc.
- Understand use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity
- Understand Geo-informatics: definition, concept, tools and techniques; their uses in precision agriculture; Crop discrimination and yield forecasting, soil mapping; fertilizer recommendation using geo-spatial technologies, spatial data and their management in GIS
- Remote sensing: concept and application in agriculture and natural resource management; Basic aspects of image processing and visual image interpretation; Global positioning system (GPS): components and its functions; Crop simulation models: concept and uses for optimization of agricultural inputs.

Course content

UNIT– I **05Hours**

- Precision agriculture: concept, techniques, issues and concerns for Indian agriculture;
- STCR approach for precision agriculture;
- Nanotechnology: definition, concept and techniques;
- Nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, etc
- Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity

UNIT II **05 Hours**

- Geo-informatics: definition, concept, tools and techniques
- Their uses in precision agriculture
- Crop discrimination and yield forecasting, soil mapping
- Fertilizer recommendation using geo-spatial technologies, spatial data and their management in GIS
- Remote sensing: concept and application in agriculture

UNIT III **05Hours**

- Remotec sensing in natural resource management
- Identifying problem soils: sodic soils, acid sulphate soils
- Basic aspects of image processing and visual image interpretation
- Global positioning system (GPS): components and its functions
- Crop simulation models: concept and uses for optimization of agricultural inputs

UNIT IV **05Hours**

- Fertilizers recommendations based of VRT and STCR techniques;
- Formulation, characterization and applications of nano-particles in agriculture;
- Introduction to GIS software, creation and editing of spatial data, creation of thematic maps;
- Introduction to remote sensing/image processing software;
- Visual and digital interpretation of remote sensing images;

UNIT V **05 Hours**

- Crop simulation models: concept and uses for optimization of agricultural inputs
- Multi-spectral remote sensing for soil mapping;
- Monitoring of crop stress (biotic/abiotic) using geo-spatial technology;

- Use of GPS for agricultural survey.

Recommended Books:(LatestEditions)

- JainNK:ConciseConceptsofNanoscienceandNanomaterials, Scientific Publishers, India
- JoshiBM:NewVistasofOrganicFarming,2ndEd., Scientific Publishers
- ChouhanTS:RemoteSensingandGISGPSbasedResourceManagement, Scientific Publishers

Reference Books

- ChouhanTS:Geo-InformaticsforCombatingLandDegradationandDesertification, Scientific Publishers
- Joshi D C:TextBookofGeo-InformaticsandNanotechnologyforPrecisionFarming, Scientific Publishers (India)
- TarafdarJC.:Nanofertilizers:ChallengesandProspects, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AGMP 355.1	2	3	3	-	-	-	-	-	1	2	-	2
AGMP 355.2	1	1	3	3	-	2	-	2	-	2	3	2
AGMP 355.3	3	3	2	3	4	1	2	2	-	2	2	-
AGMP 355.4	3	3	2	2	2	3	1	1	2	-	1	-
AGMP 355.5	1	2	1	1	-	2	-	-	-	-	2	1

Course Code	**AST 356**			
Course Title	**COMPUTER APPLICATION AND AGRICULTURE INFORMATICS**			
Category				
LTP & Credits	L	T	P	Credits

	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartafundamental knowledge application of computers in agricultural management, e-agriculture vis-à-vis ICT for scaling agricultural processes

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions,database, concepts and types, uses of DBMS in Agriculture.
- Know World Wide Web (WWW) concepts and components and introduction to computer programming languages, concepts and standard input/output operations, in agriculture.
- Understand e-Agriculture, concepts and applications, use of ICT in Agriculture, Computer Models for understanding plant processes, IT application for computation of water and nutrient requirement of crops.
- Understand the role of computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc
- Learn Geospatial technology for generating valuable agri-information, Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions.Preparation of contingent crop-planning using IT tools.

Course content

UNIT– I **04Hours**

- Introduction to Computers, Operating Systems, definition and types
- Applications of MS-Office for document creation andediting, Data presentation, interpretation and graph creation, statistical analysis,
- Mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture,
- World Wide Web (WWW): Concepts and components.

- Introduction to computer programming languages, concepts and standard input/output operations

UNIT II **04 Hours**

- e-Agriculture, concepts and applications,
- Use of ICT in Agriculture. Computer Models for understanding plant processes.
- IT application for computation of water and nutrient requirement of crops,
- Computer-controlled devices (automated systems) for Agri-input management,
- Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc;.

UNIT III **04Hours**

- Remote sensing in natural resource management
- Geospatial technology for generating valuable agri-information.
- Decision support systems, concepts, components and applications in Agriculture,
- Agriculture Expert System, Soil Information Systems etc for supporting
- Farm decisions.Preparation of contingent crop-planning using IT tools

PRACTICAL

UNIT IV **04 Hours**

- Fertilizers recommendations based of VRT and STCR techniques;
- Formulation, characterization and applications of nano-particles in agriculture;
- Introduction to GIS software, creation and editing of spatial data, creation of thematic maps;
- Introduction to remote sensing/image processing software;
- Visual and digital interpretation of remote sensing images;

UNIT V **04 Hours**

- Crop simulation models: concept and uses for optimization of agricultural inputs
- Study of Computer Components, accessories, practice of important DOS Commands.
- Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management.
- Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document.
- MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system.

UNIT VI **04 Hours**

- Introduction to World Wide Web (WWW).Introduction of programming languages.
- Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost;
- Computation of water and nutrient requirements of crop using CSM and IT tools.
- Introduction of Geospatial Technology for generating valuable information for Agriculture.
- Hands on Decision Support System.
- Preparation of contingent crop planning.

Recommended Books:(LatestEditions)

- Chowdhury A, Biswas A, Pareek M and Chakraborty A : Agriculture Informatics, Wiley-Scrivener.
- Sharma M,Bhat A Iqbal,M and Bhat J:Computer in Agriculture, Neel Kamal Publishing Pvt Ltd

Reference Books

- Vanitha G and Kalpana M Kalpana Agro-Informatics, Agribios Publishers(India)
- Newman ME: Computer Application in Agriculture Business, Ver Media Inc

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12

AST 356.1	2	3	3	-	-	-	-	-	1	2	-	-
AST 356.2	3	1	3	3	-	2	-	2	-	3	3	2
AST 356.3	2	3	2	3	4	1	2	2	-	-	2	2
AST 356.4	3	2	2	2	2	3	1	1	2	1	1	2
AST 356.5	2	2	1	1	-	2	-	-	-	-	2	-

Course Code	**HORT(A) 357**
Course Title	**POST-HARVEST MANAGEMENT AND VALUE-ADDITION OF FRUITS AND VEGETABLES**

Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	20			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on importance of post-harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Visualize the post-harvest losses of fruits and vegetables by different means
- Understand that Pre-harvest factors affect postharvest quality, maturity, ripening and changes occurring during ripening;
- Understand how respiration and factors affecting respiration rate,harvesting and field handling, Storage (ZECC, cold storage, CA, MA, and hypobaric) affect the harvest.
- Learn the Value addition concept, Principles and methods of preservation producing Jam, jelly, marmalade, preserve, candy
- Learn the concept of fermented and non-fermented beverages,tomato products,drying/ dehydration of fruits and vegetables – Concept and methods; Canning, Packaging of products.

Course content

UNIT– I **05 Hours**

- Importance of post-harvest processing of fruits and vegetables,
- Extent and possible causes of post harvest losses;
- Pre-harvest factors affecting postharvest quality, maturity,
- ripening and changes occurring during ripening;
- Respiration and factors affecting respiration rate;

UNIT II **05 Hours**

- Harvesting and field handling
- Storage (ZECC, cold storage, CA, MA, and hypobaric)
- Value addition concept; Principles and methods of preservation; Jam, jelly, marmalade, preserve, candy
- Fermented and non-fermented beverages; Tomato products
- Drying/ Dehydration of fruits and vegetables – Concept and methods; Canning;Packaging of products.

PRACTICAl

UNIT III **05 Hours**

- Remotec sensing in natural resource management
- Applications of different types of packaging, containers for shelf life extension.
- Effect of temperature on shelf life and quality of produce.
- Demonstration of chilling and freezing injury in vegetables and fruits.
- Extraction and preservation of pulps and juices.

UNIT IV **05 Hours**

- Preparation of jam, jelly,
- RTS, nectar, squash, fruit bar and tomato products.
- Quality evaluation of products -- physico-chemical and sensory.
- Visit to processing unit/ industry.
- Estimation of return due to post-harvest processin

Recommended Books:(LatestEditions)

- SudRK:FlowersandVegetablesofIndia Scientific Publishers
- FAO:Technical Manual on small-scale Processing ofFruitsandVegetables, Rome Italy

- Nair B:FundamentalsofVegetableCropProduction, Scientific Publishers.
- Nath A: Post Harvest Management and Production ofImportantHorticulturalCrops, Scientific Publishers.

Reference Books

- SinghSP:ProductionTechnologyofFruitCropsinWasteland, Scientific Publishers, India
- ReddyPP:ProductivityEnhancingTechnologiesforHorticulturalCrops, Sentific Publishers
- RanaMK:Vegetables&theirAlliedasProtectiveFood, Scientific Publishers, India
- CanovasGVB:HandlingandpreservationofFruitsandVegetableby Combined Methods for Rural Areas, FAO Agricultural Services Bulletin 149. Rome, Italy

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
HORT (A)357.1	2	3	3	-	-	-	-	-	1	-	-	2
HORT (A)357.1	3	1	3	3	-	2	-	2	-	-	3	-
HORT (A)357.1	-	3	2	3	4	1	2	2	-	-	2	2
HORT (A)357.1	3	3	2	2	2	3	1	1	2	-	1	-
HORT (A)357.1	1	2	1	1	1	2	-	-	-	-	2	2

Course Code	**AEG(A)358**			
Course Title	**RENEWABLE ENERGY AND GREEN TECHNOLOGY**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2

Total Contact Hours	25
Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on use of renewable energy and green technology for a sustainable crop productivity.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know the classification of energy sources, contribution of these of sources in agricultural sector
- Familiarize with biomass utilization for bio-fuel production and their application,
- Familiarize with types of biogas plants and gasifiers, biogas, bio-alcohol, bio-diesel and bio-oil production and their utilization as bio-energy resource, introduction of solar energy,
- Familiarize with solar energy gadgets, solar cooker, solar water heater, application of solar energy, solar drying, solar pond, solar distillation,
- Know about solar photovoltaic system and their application, introduction of wind energy and their application.

Course content

UNIT– I **05Hours**

- Classification of energy sources, contribution of these of sources in agricultural sector,
- Familiarization with biomass utilization for bio-fuel production and their applicationPre-harvest factors affecting postharvest quality, maturity,
- Familiarization with types of biogas plants and gasifiers, biogas, bio-alcohol, bio-diesel Respiration and factors affecting respiration rate;
- Bio-oil production and their utilization as bio-energy resource
- Introduction of solar energy, collection and their application

UNIT II **05 Hours**

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

PRACTICAl

UNIT III **05Hours**

- Familiarization with renewable energy gadgets.
- To study biogas plants,
- To study gasifier,
- To study the production process of biodiesel,
- To study briquetting machine,

UNIT IV **05 Hours**

- To study briquetting machine,
- To study the production process of bio-fuels.
- Familiarization with different solar energy gadgets.
- To study solar photovoltaic system:
- To Solar light, solar pumping, solar fencing.

- **UNIT V** **05Hours**
- Solar motors

- To study solar cooker,
- To study solar drying system.
- To study solar distillation and solar pond.

Recommended Books:(LatestEditions)

- Patel K K: AText Book on Fundakentals of Renewable Energy and Green Technology, Kushal Publications
- Bhatia S C and Gupta R K.Text Book of Renewable Energy, Woodhead Publishing India Pvt Ltd

Reference Book

- Deogirikar A andMohod A.Text Book on Renewable Energy and Green Technology, S K Dadhich & Laxmi Lal Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
AFG (A) 358.1	2	3	3	-	-	-	-	-	1	-	-	1
AFG (A) 358.2	3		3	3	-	2	-	2	-	-	3	2
AFG (A) 358.3		3	2	3	4	1	2	2	-	-	2	-
AFG (A) 358.4	3	3		2	2	3	1	1	2	-	1	-
AFG (A) 358.5	1	2	1	1	1	2	-	-	-	-	2	2

Course Code	**FSN 359**			
Course Title	**PRINCIPLES OF FOOD SCIENCE AND NUTRITION**			
Category				
LTP & Credits	L	T	P	Credits
	2		0	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge Concept of food science, food composition and chemistry and nutritionin food.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Know concepts of food science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.)
- Learn food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactive, important reactions)
- Understand food microbiology (bacteria, yeast, moulds, spoilage of fresh and processed foods, production of fermented foods)
- Principles and methods of food processing,concept of food scienceand preservation (use of heat, low temperature, chemicals, radiation, drying etc.),food and nutrition, Malnutrition (over and under nutrition), nutritional disorders.
- Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

Course content

UNIT– I **12Hours**

- Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.);
- Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions);
- Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods,
- Production of fermented foods);
- Principles and methods of food processing

UNIT II **12 Hours**

- Concept of Food scienceand preservation (use of heat, low temperature, chemicals, radiation, drying etc.)

- Food and nutrition,
- Malnutrition (over and under nutrition), nutritional disorders;
- Energy metabolism (carbohydrate, fat, proteins);
- Balanced/ modified diets, Menu planning,
- New trends in food science and nutrition.

Recommended Books:(LatestEditions)

- Rodey Sunetra,Food Science and Nutrition Oxford University Press
- Oxford University Press
- GuptaSwati and Bagga Minna,Principles of Food Science And Nutrition
- Kalyani Publications,

Reference Books

- Vaclavik V: Essentials of Food Science, Springer Nature
- Jianquan K and Kewei C: Essentials of Food Chemistry, Springer nature
- Springer's Briefs in Food Health and Nutrition, Springer Nature

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
FSN 359.1	2	3	3	-	-	-	-	-	1	-	-	2
FSN 359.2	3		3	3	-	2	-	2	-	-	3	2
FSN 359.3	2	3	2	3	4	1	2	2	-	-	2	2
FSN 359.4	3	3	1	2	2	3	1	1	2	-	1	-
FSN 359.5	1	2	1	1	1	2	-	-	-	-	2	-

Course Code	**ES 360**			
Course Title	**ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	25			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on environment, its natural resources and management of disaster occur due to floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, climatic change global warming, sea level rise, ozone depletion.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the different natural resources of the environment and disaster due to floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, climatic change: global warming, Sea level rise, ozone depletion etc
- Understand multidisciplinary nature of environmental studies scope and importance. natural resources: renewable and non-renewable resources. natural resources and associated problems
- Able to know the natural resources viz.forest, water, food energy, land, mineral and diverse ecosystems.
- Know human population and the environment: population growth, variation among nations, population explosion, aamily welfare programme. environment and human health,women and child welfare.role of information technology in environment and human health.

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

Course content

UNIT– I **05Hours**

- Multidisciplinary nature of environmental studies Definition, scope and importance.

- Natural Resources: Renewable and non-renewable resources. Natural resources and associated problems)
- Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefitsand problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies

UNIT II **05 Hours**

- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles
- Ecosystems • Concept of an ecosystem. • Structure and function of an ecosystem. • Producers, consumers and decomposers. • Energy flow in the ecosystem. • Ecological succession. • Food chains, food webs and ecological pyramids. • Introduction, types, characteristic features, structure and function
- Forest ecosystem;. Grassland ecosystem , Desert ecosystem, Aquatic ecosystems (ponds,
- streams, lakes, rivers, oceans, estuaries) .

UNIT III **05 Hours**

- Biodiversity and its conservation:- Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India.

- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity Environmental Pollution: definition, cause, effects and control measures of :-Air pollution Water pollution; Soil pollution; d. Marine pollution ; Noise pollution, Nuclear Hazards

- To study the production process of bio-fuels.solid waste management: causes, effects and control measures of urban and industrial wastes.
- Role of an individual in preventing pollutionFrom Unsustainable to Sustainable development,Urban problems related to energy,Water conservation, rain water harvesting,

UNIT IV **05 Hours**

- Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.
- Environment Protection Act.; Air (Prevention and Control of Pollution) Act.; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation.
- Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme.Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare,Role of Information Technology in Environment and human health.
- Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.
- Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents

PRACTICAL

UNIT V **05 Hours**

- Disaster Management- Effect to migrate natural disaster at national and global levels.International strategy for disaster reduction.Concept of disaster management,

national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media.Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

- Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.
- Case Studies and Field work. Visit to a local area to document environmental assets river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban/ Rural/ Industrial/ Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.
- Expected impact of climate change on agricultural production and water resources, Mitigation Strategies, Economics of climate change. Disaster Management introduction,
- Natural and Manmade Disaster Studies, Informatics for Disaster Management, Quantitative Techniques for Disaster Management Environmental Impact Assessment (EIA) and Disaster Management Disaster Management Policy Environmental Modelling. Role of Information Technology in Environment and human health - Case Studies.

Recommended Books:(LatestEditions)

- ThakurV:ATextBookofEnvironmentalScience, Scientific Publishers
- MisraR: EcologyWorkbook, Kalyani Publishers
- MisraR:IndianManualofPlantEcology, Scientific Publishers

Reference Books

- Singh P:PerspectivesinPlantEcologyandEnvironmentalBiology, Scientific Publishers
- ChouhanTS:SpaceTechnologyandGISforDisasterMonitoringandMitigation, Scientific Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12

ES 360.1	2	3	3	-	-	-	-	-	1	-	-	-
ES 360.2	3		3	3	-	2	-	2	-	-	3	2
ES 360.3	2	3	2	3	4	1	2	2	-	-	2	2
ES 360.4		3		2	2	3	1	1	2	-	1	1
ES 360.5	1	2	1	1	1	2	-	-	-	-	2	

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ELECTIVE COURSES

Course Code	**EC 361**
Course Title	**AGRUCULTURAL WASTE MANAGEMENT**

Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on agricultural waste management, nature and characteristics of agricultural waste and their impact on the environment, kinds of wastes, classification, role of soil and plants in waste management.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand agricultural waste management, nature and characteristics of agricultural waste and their impact on the environment, kinds of wastes, Classification, role of soil and plants in waste management.
- Know the sources of waste, impact of waste on soil and plant quality.biological processes of waste management, utilization and recycling of agricultural waste
- Learnpotential of recyclable crop Residues and its management,*In-situ* management of agriculture waste, composting and vermicomposting for bio conservation of biodegradable waste,
- Understand biogas technology, agricultural waste and water, air and animal resources, impacts of waste on human, animal health and environment.
- Act on management of bedding and litter, wasted feed, run-off from feed lots and holding areas and waste water form dairy parlours, agro-waste recycling through farming system, waste management machineries, environmental benefit of waste management.

Course content

UNIT– I **06Hours**

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- Introduction to agricultural waste management,

- Nature and characteristics of agricultural waste and their impact on the environment,
- Kinds of wastes, Classification, role of soil and plants in waste management,
- Sources of waste, impact of waste on soil and plant quality
- Biological processes of waste management

UNIT II **06 Hours**

- Utilization and Recycling of Agricultural waste, Potential of Recyclable Crop Residues and its management,
- In-situ management of agriculture waste,
- Composting and Vermicomposting for bio conservation of biodegradable waste,
- Biogas Technology, Agricultural waste and water, air and animal resources,
- Impacts of waste on human, animal health and environment.

UNIT III **06 Hours**

- Management of bedding and litter, wasted feed,
- Run-off from feed lots and holding areas and waste water form dairy parlours,
- Agro-waste recycling through farming system,
- Waste management machineries,
- Environmental benefit of waste management.

PRACTICAL

UNIT IV **06 Hours**

- Collection and preparation agricultural waste sample. Determination of pH, EC, CECe, heavy metals, BOD, COD, TSS, TDS, NH_4, Total P, and dissolved reactive P.
- Nutrient status (N, P, K, secondary and micronutrients) analysis of agricultural waste.
- Waste management equipment operation, Maintenance and safety hazards, computer software and models.

- Survey of different agri waste from live stock, dairy, poultry, food processing, fruit and vegetable and agri-chemicals,
- Preparation of compost, vermicomposting, biogas and analysis of compost.

Recommended Books:(LatestEditions)

- Loehr R: Agricultural Waste Management-Problems, Processes and Approaches, Academic Publishers Inc

Reference Books

- Sannigrahi A K: Agricultural Waste Management for Sustainable Future, New India Publishing Agency
- Waste to Resources-A Waste Management Handbook, TERI Press, New Delhi

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 361.1	2	3	3	-	-	-	-	-	1	-	-	2
EC 361.2	3		3	3	-	2	-	2	-	-	3	2
EC 361.3	2	3	2	3	4	1	2	2	-	-	2	1
EC 361.4	2	3		2	2	3	1	1	2	-	1	-
EC 361.5	1	2	1	1	1	2	-	-	-	-	2	-

Course Code	**EC 362**			
Course Title	**DEFICIENCY AND TOXICITY OFELEMENTSIN SOIL, PLANT AND WATER**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on deficiency and toxicity of nutrient elements in soil, plant and water and its consequence on soil pollution and crop productivity.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the Essential Nutrients and their criteria of being Essential
- Classification of nutrients, list of nutrient and plant usable forms, average concentration of nutrient elements in crops.
- Nutrient movement to plant roots, growth laws and approaches used in plant nutrition, function of nutrients in plant,
- Evaluation of soil fertility and plant nutrition,Identification of nutrient deficiencies and toxicities, Plant analysisSoil tests and critical levels of deficiencies
- Nutrient management in intensive agricultureIntegrated nutrient management, Increasing nutrient use efficiency

Course content

UNIT– I **06 Hours**

- Introduction, Essential nutrients and their criteria
- Classification of nutrients, list of nutrient and plant usable forms,
- Average concentration of nutrient elements in crops
- Nutrient movement to plant roots
- Growth Laws and approaches used in plant nutrition

UNIT II **06 Hours**

- Growth Laws and approaches used in plant nutrition
- Function of nutrients in plant
- Evaluation of soil fertility and plant nutrition
- Dentification of nutrient deficiencies and toxicities
- Plant analysis for different nutrients

UNIT-III **06 Hours**

- Introduction, essential nutrients and their criteria

- Classification of nutrients
- List of nutrient and plant usable forms,
- Average concentration of nutrient elements in crops
- Nutrient movement to plant roots

UNIT-IV **06Hours**

- Soil tests and critical levels of deficiencies
- Plant and water test
- Nutrient management in intensive agriculture
- Integrated nutrient management
- Increasing nutrient use efficiency

PRACTICAL

UNIT-V **06 Hours**

- Collection and preparation of soil samples
- Estimation of pH, EC, Organic C
- available N, P, K, S, Ca and Mg, Na and
- micronutrient and heavy metals viz. Pb, Cd, Ni etc
- Plant sampling and sample preparation for analysis;
- Estimation of total C, N, P, K, S and micronutrient content in plant.

Recommended Books:(LatestEditions)

- Das D K: Introductory Soil Science, Kalyani Publishers
- AryaRL:FundamentalsofSoilScience, S Publisherscience, Technology Scientific
- JacksonML.:SoilChemicalAnalysis:AdvancedCourse, Prentice Hall of India Ltd.
- BearFE:ChemistryofTheSoil,2ndEd.Scientific Publishers
- Richard LA (1954) Diagnosis and Improvement of Saline Alkali Soils, Agriculture, 160, Handbook 60. US Department of Agriculture, Washington DC.

Reference books

- Rathinasamy,A:FundamentalsofSoilScience, Scientific Publishers
- GuptaSK:StandardMethodsforAnalysisofSoilPlantandWater, Scientific Publishers
- FriedM:TheSoil-PlantSysteminRelationtoInorganicNutrition, Academic Press, NY
- FAO:TheUseofSalineWatersforCropProduction, FAO, Rome
- USDA:SoilSurveyManualNewRevisedEd.. Riverside, USA
- PiperC:SoilandPlantAnalysis., Wolters and Kluwers
- Ryan,J:SoilandPlantAnalysis:LaboratoryManual, USDA, Pennsylvania.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC362.1	2	3	3	-	-	-	-	-	1	-	-	2
EC 362.2	3		3	3	-	2	-	2	-	-	3	1
EC 362.3	3	3	2	3	4	1	2	2	-	-	2	1
EC362.4	3	3		2	2	3	1	1	2	-	1	2
EC 362.5	1	2	1	1	1	2	-	-	-	-	2	-

Course Code	**EC 363**			
Course Title	**DETECTION AND DIAGNOSISOF PLANT DISEASES**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2
Total Contact Hours	24			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on plant diseases – definition, symptoms and signs, causes of plant diseases, disorder, abiotic factors and its impact on plant health.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the symptoms and signs, causes of plant diseases, disorder, abiotic factors and its impact on plant health.
- Understand outlines of serological and nucleo-based techniques for detection of different plant pathogens.
- Know fungal disease diagnosis symptomatology, Koch's postulate, Different isolation and purification techniques of fungal pathogens, inoculation techniques of fungal pathogens.
- Know different techniques of preservation of microorganisms. Symptoms of bacterial diseases.
- Understandisolation of bacteria from rhizosphere, phyllo-sphere and diseased samples, specific media, Bacterial stains and staining methods. Different inoculation techniques of bacteria.

Course content

UNIT– I **06Hours**

- Plant diseases-an enigma
- Plant diseases – definition, symptoms and signs,
- Causes of plant diseases, disorder, abiotic factors and its impact on plant health,
- Biotic vs. abiotic plant problems
- Outlines of serological and nucleo-based techniques for detection of different plant pathogens

UNIT II **06 Hours**

- Fungal disease diagnosis symptomatology, Koch's postulate,
- Different isolation and purification techniques of fungal pathogens,
- Inoculation techniques of fungal pathogens.
- Different techniques of preservation of microorganisms.
- Symptoms of bacterial diseases
-

UNIT-III **06 Hours**

- Isolation of bacteria from rhizosphere,
- Phyllosphere and diseased samples, specific media,
- Bacterial stains and staining methods.
- Different inoculation techniques of bacteria.
- Microscopy

PRACTICAL

UNIT-IV **06Hours**

- Method to prove koch's postulates with fungal and bacterial pathogens,
- Mechanical/ sap inoculation techniques for viral disease.
- Pure culture techniques, use of selective media to isolate pathogens
- .Preservation of plant pathogens and disease specimens, use of haemocytometer, micrometer, cameralucida for micrometric studies of fungal pathogens.
- Field trips for development of keys for diagnosis of diseases and assessment of disease severity.

Recommended Books:(LatestEditions)

- Gullino L M**,** Bonants**,** P J. M:Detection and Diagnostics of Plant Pathogens, Springer
- Meena A K , Godara S L and Meena P N :Detection and Diagnosis of Plant Diseases, Scientific Publishers

Reference Books

- Gullino M L and Bonants PJM:Detection and Diagnostics of Plant Pathogen, Springer Nature
- Narayanaswamy P: Plant Pathogen Detection and Disease Diagnosis, MarcelDekker Inc

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC363.1	2	3	3	-	-	-	-	-	1	-	-	2
EC 363.2	3		3	3	-	2	-	2	-	-	3	2
EC 363.3	2	3	2	3	4	1	2	2	-	-	2	2
EC363.4	3	3		2	2	3	1	1	2	-	1	-
EC 363.5	1	2	1	1	1	2	-	-	-	-	2	1

Course Code	**EC 364**			
Course Title	**NON-INSECTPESTS OF CROPS AND THEIR MANAGEMENT**			
Category				
LTP & Credits	L	T	P	Credits
	1		1	2

Total Contact Hours	24
Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on economic importance of plant parasitic nematodes, phytophagous mites, rodents, agriculturally important birds, snails and slugs, their morphology, taxonomy, classification, biology and behaviour.

Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand the economic importance of plant parasitic nematodes, phytophagous mites, rodents, agriculturally important birds, snails and slugs.
- Know general characters of theseorganisms, their morphology, taxonomy, classification, biology and behaviour symptomatology and management
- Learn tmorphological study and identification of agriculturally important mites, nematodes, rodents, birds, snails and slugs etc..
- Learn collection, cleaning, and preservation of the above-mentioned organisms
- Study symptoms of damage and habitat study, sampling and estimation of population.

Course content

UNIT– I **12Hours**

- History, definition and economic importance of plant parasitic nematodes,
- Phytophagous mites, rodents,
- Agriculturally important birds,
- Snails and slugs.
- General characters of aforementioned organisms,
- Their morphology, taxonomy, classification,
- Biology and behaviour symptomatology and management

PRACTICAL

UNIT II **12 Hours**

- Morphological study and identification of agriculturally important mites,
- nematodes, rodents, birds, snails and slugs etc.
- .Collection, cleaning, and preservation.
- Studies of symptoms of damage and habitat study.
- Sampling and estimation of population

Recommended Books:(LatestEditions)

- Muehlbauer F J Sarker A and Sharma B:Insect pests and their management, Scientific Publishers
- Bhattacharya R and Dey U: Non Insect Pests Damaging to Agricultural Crops LAP LAMBERT Academic Publishing

Reference Books

- Singh S B, Upadhyay S and Chaudhury R K: Non-Insect Pests and their Management, IBP Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC364.1	2	3	3	-	-	-	-	-	1	-	-	
EC 364.2	3		3	3	-	2	-	2	-	2	3	
EC 364.3		3	2	3	4	1	2	2	-	2	2	
EC364.4	3	3		2	2	3	1	1	2	-	1	
EC 364.5	1	2	1	1	1	2	-	-	-	-	2	

Course Code	**EC 365**			
Course Title	**COMMERCIAL PLANT BREEDING**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			

Pre-requisites	None

Scope: This course is designed to impart a comprehensive knowledge on types of crops and modes of plant reproduction, line development and maintenance breeding in self and cross pollinated crops for development of hybrids and seed production in commercial scale .

Course Objectives: Upon completion of this course the student should be able to:

- Understand types of crops and modes of plant reproduction, line development and maintenance breeding in self and cross pollinated crops for development of hybrids and seed production
- Learn genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc

- Understand quality seed production of vegetable crops under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.

- Know IPR issues in commercial plant breeding, DUS testing and registration of varieties under PPV & FR Act.
- Understand variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self- and cross-pollinated crops.

Course content

UNIT– I **06 Hours**

- Types of crops and modes of plant reproduction.
- Line development and maintenance breeding in self- and cross-pollinated crops (A/B/R and two line system) for development of hybrids and seed production.
- Genetic purity test of commercial hybrids.

- Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, *Brassica* etc.
- Quality seed production of vegetable crops under open and protected environment.

UNIT II **06 Hours**

- Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.
- IPR issues in commercial plant breeding
- DUS testing and registration of varieties under PPV & FR Act.
- Variety testing, release and notification systems in India.
- Principles and techniques of seed production, types of seeds, quality testing in self- and
- cross-pollinated crops

PRACTICAL

UNIT-III **06Hours**

- Floral biology in self and cross pollinated species, selfing and crossing techniques.
- Techniques of seed production in self and cross pollinated crops using A/B/R and two line system.
- Learning techniques in hybrid seed production using male-sterility in field crops.
- Understanding the difficulties in hybrid seed production,
- Tools and techniques for optimizing hybrid seed production.

UNIT-IV **06 Hours**

- Collection and preparation of soil samples
- Concept of rouging in seed production plot.
- Concept of line its multiplication and purification in hybrid seed production.
- Role of pollinators in hybrid seed production.
- Hybrid seed production techniques in sorghum, pearl millet,

UNIT-V **06 Hours**

- Maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops.

- Sampling and analytical procedures for purity testing and detection of spurious seed.
- Seed drying and storage structure in quality seed management.
- Screening techniques during seed processing viz., grading and packaging.
- Visit to public private seed production and processing plants.

Recommended Books:(LatestEditions)

- Khare D:SeedTechnology,2ndEd., Scientific Publishers
- BasraAS:HandbookofSeedScienceandTechnology, ICAR, New Delhi
- MackayD.B:SeedTechnologyintheTropics, Scientific Publishers

Reference Books

- Khare D. : Principles of Seed Technology(ConciseEdition), Scientific Publishers
- StoskopfN.C:Plantbreeding:theoryandPractice, Taylor and Francis.
- Singh,B.D:MolecularPlantBreeding, Kalyani Publishe

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC365.1	2	3	3	-	-	-	-	-	1	-	-	2
EC 365.2	3		3	3	-	2	-	2	-	-	3	2
EC 365.3	2	3	2	3	4	1	2	2	-	-	2	-
EC365.4	3	3		2	2	3	1	1	2	-	1	2
EC 365.5	1	2	1	1	1	2	-	-	-	-	2	-

Course Code	**EC 366**			
Course Title	**MICRO-PROPAGATION TECHNOLOGIES**			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	30			

Pre-requisites	None

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on Organ culture(tissue, seed, embryo, organ, callus, cell), for micro-propagation of planting materials achieving soma-clonal variation.

Course Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Knowadvantages and limitations of micro-propagation
- Learn types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation,
- Followaxillary bud proliferation (shoot tip and meristem culture, bud culture),
- Organogenesis (callus and direct organ formation),
- Understand somatic embryogenesis, cell suspension cultures, Clonal variation

Course content

UNIT– I **10Hours**

- Introduction, History, Advantages and limitations;
- Types of cultures (seed, embryo, organ, callus, cell),
- Stages of micropropagation, Axillary bud proliferation
- (Shoot tip and meristem culture, bud culture),
- Organogenesis (callus and direct organ formation),

UNIT II **10 Hours**

- Somatic embryogenesis, cell suspension cultures,
- Production of secondary metabolites,
- Clonal variation, Cryopreservation.
- Cryopreservation
- Multiplication of planting materials

PRACTICAL

UNIT-III **10 Hours**

- Floral biology in self and cross pollinated species, selfing and crossing techniques.
- Identification and use of equipments in tissue culture Laboratory,
- Nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques for explants,
- Preparation of stocks and working solution,
- Preparation of working medium, Culturing of explants:
- Seeds, shoot tip and single node, Callus induction,
- Induction of somatic embryos regeneration of whole plants from different explants,
- Hardening procedures.

Recommended Books:(LatestEditions)

- Debergh P and Richard H: Micropropagation Technology and Application, Springer.
- Smith R: Plant Tissue Culture-Techniques and Experiments, Elsevier

Reference Books

- Debergh P: Micropropagation- Technology and Application, Springer Nature.
- Stefenon V M: Micropropagation- Methods and Effects, Nova Science Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 366.1	2	3	3	-	-	-	-	-	1	-	-	
EC 366.2	3		2	3	-	2	-	2	-	-	3	
EC 366.3	3	3	2	3	4	1	2	2	-	-	2	
EC366.4	3	3	3	2	2	3	1	1	2	-	1	
EC 366.5	1	2	1	1	1	2	-	-	-	-	2	

Course Code	**EC 367**			
Course Title	**AGRICULTURAL DEVELOPMENT AND POLICY ANALYSIS**			
Category				
LTP & Credits	L	T	P	Credits

	2		1	3
Total Contact Hours	32			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge onAgricultural Policy,major challenges in Indian agriculturenational agricultural policy, food and nutritional security, human resource development, transfer of technology, capacity building, input management, incentives inagriculture, for agriculture,institutional structure,risk management, management reforms.

.

Course Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Understand Agricultural Policy, major challenges in Indian agriculture, national agricultural policy, food and nutritional security, human development, transfer of technology, capacity building, input management-incentives for agriculture, investment for agriculture, institutional structure, risk management, management reforms.

- Know Contract farming- rationality in India- benefitsissues- framework of contract farming-centralized model-nucleus model-multipartite model-informal model-intermediary model—issues in agreements-legal considerations & enforcements-acts-APMC and contract farming- case studies in India.

- Understand protocols of organic farming -concepts- principles-food quality & safety-economics--NSOP- standards & certification procedures-permitted and non- permitted inputs-organic logo.Crop insurance - history-type-agricultural insurance companies-experimental crop insurance-comprehensive crop insurance-role of various agencies- crop insurance products- problems in insurance- global picture.

- Learn Cooperative laws- types- formations & registrations- first meeting- amendment of bye-laws- membership privileges & duties- -property & funds-audit, inquiry inspection & supervision – act of multistate societies.

- Aware off WTO TRIPS law- functions-principles –agreements-agriculture -sanitary and phytosanitary measures-anti-dumping, subsidies, safeguards –contingencies and Indian economy-IPR WIPO and Indian protection systems.Know IPR issues in commercial plant breeding, DUS testing and registration of varieties under PPV & FR Act.

Course content

UNIT– I **04 Hours**

- Agricultural Policy-major challenges in Indian agriculture-national
- Agricultural policy-food and nutritional security-
- Human resource development-transfer of technology
- Capacity building-input management-incentives for agriculture
- Investment for agriculture-institutional structure-risk management- management reforms.

UNIT II **04 Hour**

- Land policies- reforms-objectives-importance in India-land holdings-
- Systems of ownership- private-large and small holdings-collective& communal ownership
- Farm tenancy-land tenure & tenancy reforms-ceilings-consequences
- Implications of land reforms. Land lease and mortgages Acts-
- Registration- terms of lease- right to renewal- lease registration- transfer systems.

UNIT-III **04 Hours**

- Contract farming- rationality in India-
- Benefits-issues- framework of contract farming-

- Centralized model-nucleus model-multipartite model-
- Informal model-intermediary model—issues in agreements-
- Legal considerations & enforcements-acts-APMC and contract farming- case studies in India.

UNIT-IV **04 Hours**

- Protocols of organic farming -concepts- principles
- Food quality & safety-economics--NSOP- standards and
- Certification procedures-permitted and non- permitted inputs-organic logo.
- Crop insurance - history-type-agricultural insurance companies-experimental crop insurance-
- Comprehensive crop insurance-role of various agencies- crop insurance products-problems in insurance- global picture

UNIT-V **04 Hours**

- WTO TRIPS law- functions-principles –agreements-agriculture -sanitary and phytosanitary measures-anti-dumping,
- subsidies, safeguards –contingencies and Indian economy-IPR WIPO and Indian protection systems.
- Variety protection and Farmers' right- needs- consequences in economy- breeders' rights-public interests-licensing-
- international frameworks-condition of registrations—benefit sharing- certification and business.
- Bio-security norms and laws-challenges—international organizations-legal dimensions-Cartagena protocol &diversity act.

UNIT-VI **04 Hours**

- Banking law & RBI act- internet banking –fraud & information technology act.
- Wild life protection act and environmental laws-conservation & community reserves-tourism & poaching action plan-

- forest laws- rights duties and forensic- constitutional provisions of environment- mandatory models-T
- The India model- air water & international issues

UNIT-VII **04 Hours**

- Estimation of human development index, Identification of risk in local agricultural systems,
- Estimation of mortgages- case study on contract farming - farmers perception of organic farming, economics of traditional & organic farming- consumers approaches on organic products,
- Assessment of risk and insurance in agriculture, estimation of seed replacement rates for principle crops,
- Institutional arrangements of pesticides and insecticides in agriculture, estimation of active ingredient (*ai)* applicationsin major cereals and vegetables.
- Case studies on Environmental Audit and Sustainable Agriculture. Recording of information on enactment of agricultural & allied laws in judiciary systems.

PRACTICAL

UNIT-VIII **04 Hours**

- Case studies on Environmental Audit and Sustainable Agriculture. Recording of information on enactment of agricultural & allied laws in judiciary systems.
- Estimation of human development index, Identification of risk in local agricultural systems, estimation of mortgages- case study on contract farming - farmers perception of organic farming, economics of traditional & organic farming- consumers approaches on organic products,
- Assessment of risk and insurance in agriculture, estimation of seed replacement rates for principle crops,
- Institutional arrangements of pesticides and insecticides in agriculture, estimation of active ingredient (*ai)* applicationsin major cereals and vegetables.

- Case studies on Environmental Audit and Sustainable Agriculture. Recording of information on enactment of agricultural & allied laws in judiciary systems.

Recommended Books:(LatestEditions)

- YadavS.L: AgriculturalPlanninginIndia, Scientific Publishers
- FAO Bulletin:FarmBusinessSchool, FAO, Rome
- FrancisL:FarmersTrainingEntrepreneurshipManual,Published by the World Agroforestry centre United Nations Avenue, Gigiri

Reference Books

- ObstW.J:FinancialManagementforAgribusiness, Landlinks Press
- DiwaseS:IndianAgriculture&AgribusinessManagement,3rdEd., Scientific Publishers
- CholeR.R:EntrepreneurshipDevelopmentandCommunicationSkills, Scientific Publishers
- FAO:FarmBusinessSchool, FAO, Rome.

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 367.1	2	3	3	-	-	-	-	-	1	-	-	
EC 367.2	2		3	3	-	2	-	2	-	-	3	
EC 367.3	3	3	2	3	4	1	2	2	-	-	2	
EC367.4	3	3		2	2	3	1	1	2	-	1	
EC 367.5	1	2	1	1	1	2	-	-	-	-	2	

Course Code	EC 368

Course Title	AGRICULTURAL DEVELOPMENT POLICY ANALYSIS			
Category				
LTP & Credits	L	T	P	Credits
	2		1	3
Total Contact Hours	28			
Pre-requisites	None			

Scope: Thiscourseisdesignedtoimpartacomprehensive knowledge on Statistical design for agricultural experiments estimating Test of Significance, Missing plot technique in RBD and LSD.Basic concepts of Factorial Experiments.2^2 factorial experiments. 1^{st} order asymmetrical factorial experiments, Incomplete Block designs, BIBD, Parametric relations and intra block analysis.

.

Course Objectives: Upon completionofthiscoursethestudentshouldbeableto:

- Learn Statistical design for agricultural experiments estimating Test of Significance, Missing plot technique in RBD and LSD. Basic concepts of Factorial Experiments.2^2 factorial experiments,
- Understand 1^{st} order asymmetrical factorial experiments, Incomplete Block designs, BIBD, Parametric relations and intra block analysis.
- Know Mendel's law of segregation, Detection and Estimation of Linkage, Estimation of Genetic Parameters, Discriminant function, Multivariate methods of studying Genotypic divergence. Hardy Weinberg Law,

- Understand Sampling vs. Complete enumeration, Estimation of sample size.Sampling errors and non-sampling errors. Simple random sampling with replacement and without replacement,
- Understand Estimation of mean and population proportion and their standard errors, PPS sampling, Cluster sampling and Stratified random sampling. Multi stage and multi-phase sampling.

Course content

UNIT– I **07Hours**

- Statistical design for agricultural experiments estimating Test of Significance,
- Missing plot technique in RBD and LSD.
- Basic concepts of Factorial Experiments.2^2 factorial experiments.
- 1^{st} order asymmetrical factorial experiments, Incomplete Block designs, BIBD, Parametric relations and intra block analysis.
- Missing plot technique in RBD and LSD.

UNIT II **07 Hours**

- Mendel's law of segregation,
- Detection and Estimation of Linkage,
- Estimation of Genetic Parameters,
- Discriminant function, Multivariate methods of studying Genotypic divergence. Hardy Weinberg Law.
- Sampling vs. Complete enumeration,

UNIT III **07 Hour**

- Estimation of sample size.
- Sampling errors and non-sampling errors.
- Simple random sampling with replacement and without replacement,
- Estimation of mean and population proportion and their standard errors, PPS sampling,
- Cluster sampling and stratified random sampling. Multi stage and multi-phase sampling.

PRACTICAL

UNIT-IV **07 Hours**

All the above topics will be covered in practical

Recommended Books:(LatestEditions)

- Rangaswamy R :A Textbook of Agricultural Statistics, 3 rd Edition New Age International Publishers

Reference Books

- Dhamu K P :Fundamentals of Agricultural Statistics Scientific Publishers
- Rout R K and Das LK: A Textbook of Basic Agricultural Statistics Kalyani Publishers

CO PO MAPPING

Course Outcome	Programme Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
EC 367.1	2	3	3	-	-	-	-	-	1	-	-	-
EC 367.2	2		3	3	-	2	-	2	-	-	3	2
EC 367.3	3	3	2	3	4	1	2	2	-	-	2	2
EC367.4	3	3		2	2	3	1	1	2	-	1	-
EC 367.5	1	2	1	1	1	2	-	-	-	-	2	-

SEVENTH SEMESTER

AG 401 Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE & AIA) 20 (0+20)

RAWE & AIA is one of the integral parts of under-graduate programme comprising major two phases:

(a) Village attachment training programme
(b) Agro-industrial attachment

The week-wise activities along with credit hours for RAWE & AIA are given below:

Sl. No.	Activities	No. of weeks	Credit Hours
1	General orientation & on-campus training by different faculties	1	14
2	Village attachment	8	
3	Unit attachment in Univ. / College. / KVK / Research Station attachment	5	
4	Plant clinic	2	2
5	Agro-Industrial attachment	3	4
6	Project Report Preparation, Presentation and Evaluation	1	
Total		**20**	**20**

- The total number of students of the session should be divided in groups based on boy and girl students. Each group will consist of 25±5 students.

- There will be a coordinating cell at the Faculty, which will be responsible to coordinate the entire programme during 7th semester.

- Each group will be attached to a nearby village for a period of eight (8) weeks, when the programme will be managed by the departments of the faculty / associated faculties of the University mainly for rural system analysis, farm improvement planning, etc.

The week-wise activities and tasks during the programme are:

- Orientation and survey of village (1 week)
- Agronomical interventions (1 week)
- Plant protection interventions (1 week)
- Soil improvement interventions including soil sampling and testing (1 week)
- Fruit and vegetable production interventions (1 week)
- Food processing and storage interventions (1 week)
- Animal production interventions (1 week)
- Extension and transfer of technology activities (1 week)

❖ Each group will be attached to at least five (5) units (Krishi Vigyan Kendras / Research Stations / other Campus) under the University or others within the state for a period of five (5) weeks on rotation basis, wherein one week for one unit system.

- ❖ Each group will be attached to at least three (3) Agro or Cottage Industries (seed companies, rice mills, pesticide-insecticide companies, cold storages, post-harvest processing and value-addition sectors, agri-finance institutions, etc.) to get an experience of the industrial environment and working for a period of three (3) weeks on rotation basis, wherein one week for one industry system.

The activities and tasks during the programme are:

- Acquaintance with industry and staff
- Study on structure, functioning, objective and mandates of the industry
- Study on various processing units and hand-on training under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of student

- ❖ Each group will be attached to a plant clinic of the University / KVK for a period of two (2) weeks.

- ❖ Daily field observation note book and weekly diaries maintained by the students along with final report for each phase duly signed by the concerned teachers / scientists / technical persons should be submitted to the coordinating cell.

The evaluation of the student's performance will be continuous, phase-wise at each unit and terminal in nature. The total marks for RAWE & AIA may be distributed unit / attachment-wise as: village attachment (30%), unit attachment in KVK / RRS / other campus (25%), plant clinic attachment (10%), agro-industries attachment (15%) and final evaluation (20%). The final evaluation will be made through presentation of activities, group discussion and central viva-voce

EIGHTH SEMESTER

Experiential Learning Programme (ELP) **2×(0+10) = 20**

Modules for Skill Development and Entrepreneurship: A student has to register 20 credits opting for two modules of 10 (0+10) credits each from the package of modules mentioned belo

Sl. No.	Module	Credit(s)
1	Module I	10(0+10)
2	Module II	10(0+10)
	Total	**20(0+20)**

Sl. No.	Course No.	Title of Module	Credit(s)	Departments* involved
1	ELP 451	Production of Bio-agents and Botanical pesticides	10(0+10)	PPA + AEN + ACH + AEC*
2	ELP 452	Commercial Seed Production	10(0+10)	SST + AGR + AEC
3	ELP 453	Mushroom Cultivation	10(0+10)	PPA + HORT + AEX
4	ELP 454	Soil, Plant and Water Testing	10(0+10)	ACSS + AEX
5	ELP 455	Commercial Beekeeping	10(0+10)	AEN + AEC
6	ELP 456	Organic Production	10(0+10)	AGR + ACH + HORT + AEC
7	ELP 457	Commercial Sericulture	10(0+10)	AEN + AEC
8	ELP 458	Plant Tissue Culture	10(0+10)	ABT + GPB + AEX

In Experiential Learning Programme (ELP), student's performance will be evaluated on the below mentioned parameters and marks distribution patterns.

Sl. No.	Parameters	Max. Marks
1.	Project Planning and Writing	10
2.	Presentation	10
3.	Regularity	10
4.	Monthly Assessment	10
5.	Output delivery	10
6.	Technical Skill Development	10
7.	Entrepreneurship Skills	10
8.	Business networking skills	10
9.	Report Writing Skills	10
10.	Final Presentation	10
	Total	**100**