Syllabus For
B.Sc. (Hons.) Agriculture

FACULTY OF AGRICULTURE

SRI KARAN NARENDRA AGRICULTURE UNIVERSITY
JOBNER-303 329, JAIPUR (RAJASTHAN)

Programme of study for B.Sc.(Hons.) Agriculture
Semester wise distribution of courses

I Semester			
S. No.	**Course Code No**	**Course title**	**Cr. Hrs.**
1.	HORT-111	Fundamentals of Horticulture	2 (1+1)
2.	BIOCHEM-111	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)
3.	SSAC-111	Fundamentals of Soil Science	3(2+1)
4.	HORT-112	Introduction to Forestry	2 (1+1)
5.	ENG-111	Comprehension & Communication Skills in English	2 (1+1)
6.	AGRON-111	Fundamentals of Agronomy	4(3+1)
7.	BIO-111/ MATHS-111	Introductory Biology*/Elementary Mathematics*	2 (1+1)/ 2(2+0)*
8.	AGHR-111	Agricultural Heritage*	2(2+0)*
9.	EXCOM-111	Rural Sociology & Educational Psychology	2 (2+0)
10.	HVE-111	Human Values & Ethics (non gradial)	1(1+0)**
11.	NSS/NCC/PEYP	NSS/NCC/Physical Education & Yoga Practices**	2 (0+2)**
TOTAL			**18+04*+03****
*The remedial courses to be offered to the students of different streams are as under • **Agriculture stream (in 10+2)** : Introductory Biology and Elementary Mathematics • **Mathematics (in 10+2)** : Introductory Biology and Agricultural Heritage • **Biology (in 10+2)** : Elementary Mathematics and Agricultural Heritage			
II Semester			
12.	GPB-121	Fundamentals of Genetics	3(2+1)
13.	SSAC-121[@]	Agricultural Microbiology	2(1+1)
14.	AGENGG-121	Introductory Soil and Water Conservation Engineering	2(1+1)
15.	CPHYS-121	Fundamentals of Crop Physiology	2(1+1)
16.	AGECON-121	Fundamentals of Agricultural Economics	2(2+0)
17.	PPATH-121	Fundamentals of Plant Pathology	3(2+1)
18.	ENTO-121	Fundamentals of Entomology	3(2+1)
19.	EXCOM-121	Fundamentals of Agricultural Extension Education	3(2+1)
20.	CSPD-121 [©]	Communication Skills and Personality Development	2(1+1)
21.	AGRON-121	Introductory Agro-meteorology & Climate Change	2(1+1)
22.	NSS/NCC/PEYP	NSS/NCC/Physical Education & Yoga Practices**	To be continued
TOTAL			**24 (15+9)**

III Semester			
1.	AGRON-211	Crop Production Technology – I *(Kharif Crops)*	3 (2+1)
2.	GPB-211	Fundamentals of Plant Breeding	3 (2+1)
3.	AGECON-211	Agricultural Finance and Cooperation	3 (2+1)
4.	AGRINFO-211©	Agri- Informatics	2(1+1)
5.	AGENGG-211	Farm Machinery and Power	2 (1+1)
6.	HORT-211	Production Technology for Vegetables and Spices	2 (1+1)
7.	ESDM-211©	Environmental Studies and Disaster Management	3(3+0)
8.	STAT-211	Statistical Methods	2(1+1)
9.	ANISC-211	Livestock and Poultry Management	4 (3+1)
10.	NSS	NSS **	To be continued
TOTAL AGRINFO-211 is to be revised by adding 25% content of ICT with equal deletion from the existing contents of the existing course. ***Action –*** *HOD, Department of Statistics, Mathematics & Computer Science*			**24(16+8)**
IV Semester			
1.	AGRON-221	Crop Production Technology –II *(Rabi Crops)*	3(2+1)
2.	HORT-221	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)
3.	AGENGG-221	Renewable Energy and Green Technology	2(1+1)
4.	SSAC-221	Problematic Soils and their Management	2(1+1)
5.	HORT-222	Production Technology for Fruit and Plantation Crops	2(1+1)
6.	GPB-221	Principles of Seed Technology	3(1+2)
7.	AGRON-222	Farming System & Sustainable Agriculture	1(1+0)
8.	AGECON-221	Agricultural Marketing, Trade & Prices	3(2+1)
9.	ENTO-221	Insect Ecology and Principles of Integrated Pest Management	2(1+1)
10.	ENTO-222	Bio-pesticides and Bio-fertilizers (Elective Course)	3 (2+1)
11.	NSS	NSS **	To be continued
TOTAL **ENTO-221 is designed as a new course**			**23(13+10)**
V Semester			
1.	PPATH-311	Epidemiology and Integrated Disease Management	2 (1+1)
2.	SSAC-311	Manures, Fertilizers and Soil Fertility Management	3 (2+1)
3.	ENTO-311	Pests of Crops and Stored Grains and their Management	4 (3+1)
4.	PPATH-312	Diseases of Field and Horticultural Crops and their Management -I	3 (2+1)

5.	GPB-311	Crop Improvement-I *(Kharif Crops)*	2 (1+1)	
6.	EDBC-311©	Entrepreneurship Development and Business Communication	2 (1+1)	
7.	AGRON-311	Geoinformatics and Nano-technology and Precision Farming	2 (1+1)	
8.	AGRON-312	Practical Crop Production – I (*Kharif* crops)	1 (0+1)	
9.	GPB-312	Intellectual Property Rights	1(1+0)	
10.	HORT-311	Landscaping (Elective Course)	3 (2+1)	
TOTAL			***23(14+9)***	
VI Semester				
1.	AGRON-321	Rainfed Agriculture & Watershed Management	2 (1+1)	
2.	AGENGG-321	Protected Cultivation and Secondary Agriculture	2 (1+1)	
3.	PPATH-321	Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)	
4.	HORT-321	Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)	
5.	ENTO-321	Management of Beneficial Insects	2 (1+1)	
6.	GPB-321	Crop Improvement-II *(Rabi crops)*	2 (1+1)	
7.	AGRON-322	Practical Crop Production –II (*Rabi* crops)	1 (0+1)	
8.	AGRON-323	Principles of Organic Farming	2 (1+1)	
9.	AGECON-321	Farm Management, Production & Resource Economics	2 (1+1)	
10.	HORT-322	Principles of Food Science and Nutrition	2(2+0)	
11.	GPB-322	Micro-propagation Technology (Elective Course)	3 (2+1)	
TOTAL **It was resolved to approve the course contents of the elective courses as such.**				**23 (13 + 10)**

***R: Remedial courses; **NG: Non-gradial courses**

@ Course to be shared with Plant Pathology

© Common Course

Students' Eligibility

To get the eligibility for registering the EL programme, the students should have completed all the courses successfully. No student should be allowed to take up the EL programme with backlog/repeat courses. The assignment/allotment of the EL programme shall be based on merit of the student at the end of 5th Semester. A separate certificate should be issued to the students after successful completion of EL course. Allotment of EL programmes amongst students to different modules should be done strictly on the basis of merit at the end of fifth semester. In this work experience students will know exact problems of farming &suggest appropriate technology and finally useful in enhancing productivity and profitability at farmers end.

VII Semester			
S.No.	**Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)**		
	Activities	**No. of weeks**	**Credit Hours**
1	General orientation & On campus training by different faculties	1	14
2	Village attachment	8	
	Unit attachment in Univ./ College. KVK/ Research Station Attachment	5	
3	Plant clinic	2	2
	Agro-Industrial Attachment	3	4
4	Project Report Preparation, Presentation and Evaluation	1	
Total weeks for RAWE & AIA		20	20

- **Agro- Industrial Attachment:** The students would be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working.

RAWE **Component-I**

Village Attachment Training Programme

S. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions	1 week
	(Soil sampling and testing)	
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	1 week
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

RAWE **Component –II**

Agro Industrial Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing-value addition, Agri-finance institutions etc.

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry
- Study of various processing units and hands-on trainings under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry

- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

VIII Semester

Modules for Skill Development and Entrepreneurship: A student will have to be registered for 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the VIII semester, to be decided later on from the modules listed below or as per the sanction of EL units from ICAR and available existing facilities.

S. No.	Title of Topic	Cr. Hrs.
1.	Production Technology for Bioagents and Biofertilizer	0+10
2.	Seed Production and Technology	0+10
3.	Mushroom Cultivation Technology	0+10
4.	Soil, Plant, Water and Seed Testing	0+10
5.	Commercial Beekeeping	0+10
6.	Poultry Production Technology	0+10
7.	Commercial Horticulture	0+10
8.	Floriculture and Landscaping	0+10
9.	Food Processing	0+10
10.	Agriculture Waste Management	0+10
11.	Organic Production Technology	0+10
12.	Commercial Sericulture	0+10

Evaluation of Experiential Learning Programme/ HOT

S. No.	Title of Topic	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

Discipline-wise summary of credit hours

S. No.	Title of Topic	Cr. Hrs.
1.	Agronomy (Including Agril. Heritage)	24(13+11)
2.	Genetics & Plant Breeding	14(8+6)
3.	Soil Science & Agricultural Chemistry	10(6+4)

4.	Entomology	14(10+4)
5.	Agricultural Economics	10(7+3)
6.	Agricultural Engineering	8(4+4)
7.	Plant Pathology	11(7+4)
8.	Horticulture	14(8+6)
9.	Food Science	Shifted to Horti. 2(2+0)
10.	Agricultural Extension	9(6+3)
11.	Biochemistry	3(2+1)
12.	Crop Physiology	2(1+1)
13.	Microbiology	-
14.	Environmental Sciences	-
	Total	5(3+2)
15.	Statistics, Computer Application and I.P.R.	2(1+1)
16.	Animal Production	4(3+1)
17.	English	2 (1+1)
18.	Remedial Courses	04 (Biol/ Math); 04 (Agriculture)
19.	NSS/NCC/Physical Education & Yoga Practices	2(0+2)
20.	Human Values and Ethics	1(1+0)
21.	Educational Tour	2(0+2)
Total		126 + 4 (for Bio / Math / Agri.) + 5 NG 126+4+5=135 (For Bio/Math/ Agri.) + 9 credits elective
RAWE **ELP**		20 +20
Grand Total		144+20+20=184
New Courses		**24+6 (remedial)+1 (NG)**

NEW COURSES

S. No.	Course code	Title of Topic	Cr. Hrs.
1	AGRON-311	Geoinformatics, Nanotechnology and Precision Farming	2(1+1)
2	AGRON-321	Rainfed Agriculture and Watershed Management	2(1+1)
3	SSAC-221	Problematic Soils and Their Management	2(1+1)
4	AGENGG-221	Renewable Energy and Green Technology	2(1+1)
5	ENTO-321	Management of Beneficial Insects	2(1+1)
6	HORT-111	Fundamentals of Horticulture	2(1+1)
7	HORT-112	Introduction to Forestry	2(1+1)

8	AGRINFO-211	Agri- Informatics	2(1+1)
9	GPB-312	Intellectual Property Rights	1(1+0)
10	HORT-322	Principles of Food Science & Technology	2(2+0)
11	CSPD-121	Communication Skills and Personality Development	2(1+1)
12	PPATH-311	Epidemiology and Integrated Disease Management	2(1+1)
13	ENTO-221	Insect Ecology and Principles of Integrated Pest Management	2(1+1)
14	AGHR-111	Agricultural Heritage	1(1+0)*
15	BIO-111	Introductory Biology	2(1+1)*
16	MATHS-111	Elementary Mathematics	2(2+0)*
17	HVE-111	Human Values & Ethics (NG)	1(1+0)**

* Remedial courses ** Non-gradial courses

Grouping of Semester-wise Elective Courses:

It was resolved to group the elective courses as under:

S. No.	Semester	Title of elective course	Department
1	4th	1. Commercial Plant breeding 2.Biopescticieds & Bio-fertilizers /Agri-business management 3.Weed management/ Food safety & Standards	PBG Ento+Path / /Ag.Econ. Agron./ LPM
2	5th	1. Agro-chemicals 2. Landscaping 3. Protected cultivation	Soil + Ento. Horti. Agril Engg.
3	6th	1. Hitech Horticulture 2. Micro propagation Technology 3. System simulation & Agro advisory/ Agricultural journalism	Horti. PBG Agron./ Ext.

Further it was resolved to approve the contents of the following elective courses as such to be offered by a student during IV, V and VI semesters in order of their sequence.

S.No.		Courses	Credit Hours
1.	ENTO-222	Biopesticides & Biofertilizers	3(2+1)
2.	HORT-311	Landscaping	3(2+1)
3.	GPB-322	Micro propagation Technologies	3(2+1)

B. Sc. (Hons.) Agriculture, Part-I
I Semester

HORT-111	Fundamentals of Horticulture	2(1+1)

Theory

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation– methods, Fertilizer application in horticultural crops.

Practical

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

Lecture Schedule – Theory

S.No.	Title of Topic	Cr. Hrs.
1.	Horticulture - Its definition and branches, importance and scope	1
2.	Horticultural and botanical classification	1
3.	Climate and soil for horticultural crops	1
4.	Nursery raising and its importance	1
5.	Plant propagation-methods	2
6.	Propagating structures	1
7.	Seed dormancy and Seed germination	1
8.	Principles of orchard establishment	2
9.	Principles and Methods of training and pruning	1
10.	Juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy	1
11.	Medicinal and Aromatic plants- importance and scope	2
12.	Importance of plant bio-regulators in horticulture	1
13.	Irrigation – methods, Fertilizer application in horticultural crops	1

Practical Schedule

S.No.	Title of Practical Exercise	Cr. Hrs.
1.	Identification of Horticultural crops	1
2.	Identification of garden tools	1
3.	Preparation of seed bed/nursery bed	1
4.	Practice of sexual and asexual methods of propagation	3

5.	Micro-propagation	**1**
6.	Layout and planting of orchard	**2**
7.	Training and pruning of fruit trees	**1**
8.	Preparation of potting mixture	**1**
9.	Fertilizer application in different crops	**1**
10.	Layout and components of a model nursery	**2**
11.	Visits to commercial nurseries/orchard	**2**

Reference Books

S. No.	Title of Book	Author	Publisher
1	Handbook of Horticulture (2002)	Chadha, K.L.	ICAR, NewDelhi
2	A handbook of Fruit Science and Technology (2013)	D.K. Salunkhe and S.S. Kadam	CRC Press
3	Basic Horticulture (2011)	Jitendra Singh	Kalyani Publications, New Delhi
4	Basics Horticulture (2009)	K.V.Peter	New India Publishing Agency
5	Fundamentals of Horticulture2014	Kausal Kumar Misra and Rajesh Kumar	Biotech Books
6	Introduction to Horticulture (1990)	Kumar, N.	Rajyalakshmi publications, Nagarcoil, Tamilnadu
7	Basic concepts of Fruit Science (2005)	Neeraj Pratap Singh	IBDC Publishers
8	Principles of Horticulture 2nd Edn. 2014	Prasad and Kumar	Agrobios (India)
9	A handbook of Fruit Production (2010)	S. Prasad and U. Kumar	Agrobios (India)
10	Precision farming	Singh Jitender	NIPA
11	Advances in Horticulture Biotechnology Vol.-7: Diagnostics for Horticulture crops	Singh, H.P.	Westville
12	Advances in horticulture Biotechnology, Vol-1: Fruit Crops	Singh, H.P.	Westville
13	Ethnobotany: A recent approach	Kapoor, B.	Madhu
14	Plant Growth Regulators in Agriculture & Horticulture: Their Role and commercial use	Basra, A.S.	IBD
15	Precision Farming in Horticulture: Approaches and Strategies	Swain, S.	NPH
16	Biometrical methods in Horticultural Sciences	Sharma, N.	NIPA

BIOCHEM-111	Fundamentals of Plant Biochemistry and Biotechnology	3(2+1)

Theory

Importance of Biochemistry; Properties of Water, pH and Buffer.

Carbohydrate: Importance and Classification, Reducing and Nonreducing sugars, Structures and properties of Monosaccharides, Disaccharides and Polysaccharides.

Lipid: Importance and classification, Structures and properties of fatty acids including membrane lipids.

Proteins: Importance and classification, Structures, titration and zwitter ion nature of amino acids, Structural organization of proteins.

Enzymes: General properties, Classification, Mechanism of action, Allosteric enzymes.

Nucleic acids: Importance and classification, Structure of Nucleotides, Secondary and Tertiary structures.

Metabolism of carbohydrates including Glycolysis, TCA cycle and Electron Transport Chain. Metabolism of lipids: Beta oxidation and Biosynthesis.

Plant Biotechnology: Concepts, Scope and applications. Scope and applications of organ cultures, embryo, cell suspension, callus, anther, pollen and ovule culture.

Micro-propagation methods: Organogenesis, Embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance, Somatic hybridization and cybrids.

Somaclonal variation and its use in crop improvement and Cryo-preservation.

Introduction to recombinant DNA methods: Physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods.

Transgenics: PCR techniques and its applications including Molecular Markers in crop improvement and Biotechnology regulations.

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids.

Quantitative estimation of glucose/ proteins. Estimation of amino acids/lipids, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides.

Sterilization techniques. Demonstration of isolation of DNA and gel electrophoresis techniques

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Importance of Biochemistry; Properties of Water, pH and Buffer.	1
2	Carbohydrate: Importance and Classification, Reducing and Non reducing sugars.	1
3	Structures and properties of Monosaccharides, Disaccharides and Polysaccharides.	2
4	Lipid: Importance and classification.	1
5	Structures and properties of fatty acids including membrane lipids.	2
6	Proteins: Importance and classification, Structures.	2
7	Titration and zwitter ion nature of amino acids.	1
8	Structural organization of proteins.	1
9	Enzymes: General properties, Classification.	1
10	Mechanism of action, Allosteric enzymes.	1
11	Nucleic acids: Importance and classification, Structure of Nucleotides.	1
12	Secondary and Tertiary structures of nucleic acids.	1

13	Metabolism of carbohydrates including Glycolysis.	1
14	TCA cycle and Electron Transport Chain.	2
15	Metabolism of lipids: Beta oxidation and Biosynthesis.	2
16	Plant Biotechnology: Concepts, Scope and applications.	1
17	Scope and applications of organ cultures, embryo, cell suspension, callus, anther, pollen and ovule culture.	3
18	Micro-propagation methods: Organogenesis, Embryogenesis, Synthetic seeds and theirsignificance.	3
19	Embryo rescue and its significance.	1
20	Somatic hybridization and cybrids.	2
21	Somaclonal variation and its use in crop improvement and Cryo-preservation.	2
22	Introduction to recombinant DNA methods: Physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods.	3
23	Transgenics: PCR techniques and its applications.	1
24	Molecular Markers in crop improvement and Biotechnology regulations.	2

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Preparation of solution, pH & buffers.	1
2	Qualitative tests of carbohydrates.	2
3	Qualitative tests of amino acids.	2
4	Quantitative estimation of glucose/ proteins.	2
5	Estimation of amino acids/lipids.	2
6	Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides.	2
7	Sterilization techniques.	1
8	Demonstration of isolation of DNA.	2
9	Gel electrophoresis techniques	2

Reference Books

1. Conn E.E., Stumpf P.K., Bruening G. & Doi R.H. (2007) Outlines of Biochemistry (5/E). John Wiley & Sons, Singapore, New York, Chichester, Brisbane & Toronto.
2. Nelson D.L. & Cox M.M. (2004) Lehninger Principles of Biochemistry (4th & 5th E) Macmillan Worth Publication, USA & UK.
3. Goodwin T.W. & Mercer E.I. (1998). Introduction to Plant Biochemistry. Progamon Press Inc. Deffered UK.
4. De Robertis E.D.P. and de Robertis EMF (2006). Cell & Molecular Biology, BI Publications Pvt. Ltd., New Delhi.
5. Chawla H.S. (2004). Introduction to Plant Biotechnology 2/E. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Singh B.D. (2017) Plant Biotechnology. Kalyani Publishers, Ludhiana, New Delhi, Chennai, Kolkata.
7. Mittal G.K. (2018). Practical Manual, Fundamentals of Plant Biochemistry & Biotechnology. Department of Biochemistry, Sri Karan Narendra Agriculture University.

SSAC-111	Fundamentals of Soil Science	3(2+1)

Theory

Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; soil taxonomical classification and soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation;.

Practical

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample, its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity. Determination of soil texture by feel and Bouyoucos Methods. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil.Determination of soil colour.

Lecture Schedule – Theory

S. No	Title of Topic	Cr. Hrs.
1.	Soil as a natural body, Pedological and edaphological concepts of soil	1
2.	Soil genesis: soil forming rocks and minerals classification	2
3.	Weathering of rocks - Chemical, Physical and Biological	2
4.	Factors of soil formation, fundamental and specific soil forming processes	2
5.	Soil Profile	1
6.	Definition and components of soil	1
7.	Soil Physical properties- Soil texture, classifications of soil separates, importance of soil texture, particle size analysis. Stoke's law	2
8.	Soil structure and types of soil structure, mechanism of soil structure formation, management of soil structure.	2
9.	Bulk density, particle density and porosity, factors affecting them, agricultural significance and manipulation	1
10.	soil consistence and plasticity and their agricultural significance	1
11.	Soil colour and expression of soil colour with munsell soil colour chart	1
12.	soil taxonomical classification and soils of India	2
13.	Soil water classification, forces of soil water retention	2
14.	Movement of soil water and availability to plants	1
15.	Soil air, composition, gaseous exchange and its composition, importance and in plant growth	2
16.	Soil temperature; source, amount and flow of heat in soil; effect on plant growth,	2
17.	Soil reaction-pH, soil acidity and alkalinity, buffering	1
18.	effect of pH on nutrient availability	1
19.	Soil colloids, types of soil colloids and their significance	2
20.	1:1, 2:1and 2:1:1 types of layer silicates, their structure and characteristics, sources of charges on soil colloids.	2
21.	Cation and anion exchange phenomenon and factors influencing ion exchange, Base saturation	1

Practical Schedule

S. No	Title of Practical Exercise	Cr. Hrs.
1.	Study of Soil Profile in field	1
2.	Study of soil sampling tools, Collection of representative sample, its processing and storage	2
3.	Study of soil forming rocks and minerals	2
4.	Determination of bulk density of undisturbed soil by core sampler method.	1
5.	Determination of bulk density of disturbed soil by R D bottle methods	1
6.	Determination of particle density of soil by R D bottle and computation of porosity of soil	1
7.	Determination of lower and upper plastic limit of soil	1
8.	Determination of field capacity, permanent wilting point of soil and WHC	2
9.	Determination of soil texture by feel and Bouyoucos Methods.	1
10.	Determination of soil pHand electrical conductivity	1
11.	Determination of cation exchange capacity of soil	2
12.	Determination of soil colour by munsell colour chart	1

Reference Books

1. Boul S.W., Hole R.D., McCracken and Southard R.J. (1998).Soil genesis and classification Fourth Ed Panima Publishing corporation, New delhi.
2. .Baver, L.D. Gardener, W.H. and gardener W.R.(1976) Soil Physics Wiley Eastern Ltd, New Delhi
3. Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science. Tata McGraw Hill publishing Co. Ltd, New Delhi
4. Brady, N.C. and Weil, R.R. (2002) The nature and properties of soils, prentice hall of India Pvt. Ltd, M-97, Connaught Circus, New Delhi
5. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi
6. Mehra R.K. (2004) Text book of Soil Science, ICAR, New Delhi
7. ISSS (2009) Fundamentals of Soil Science, Div. of Soil Science, IARI, New Delhi
8. Chopra S.L. and Kanwar, J.S. (1991) Analytical Agricultural Chemistry, Kalyani publisher, Ludhiana
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HORT-112	Introduction to Forestry	2(1+1)

Theory

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 – 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, 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. Cultivation practices of two important fast growing tree species of the region.

Practical

Identification of tree-species. Diameter measurements using calipers and tape, 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. Visits of nearby forest based industries.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies.	2
2	Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers;	2
3	Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations.	2
4	Crown classification.	1
5	Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning.	2
6	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, age determination of trees.	3
7	Agroforestry – definitions, importance,	1
8	Criteria of selection of trees in agroforestry,	1
9	Different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens.	1
10	Cultivation practices of two important fast growing tree species of the region.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Identification of tree-species.	1
2	Diameter measurements using calipers and tape,	2
3	diameter measurements of forked, buttressed, fluted and leaning trees.	2
4	Height measurement of standing trees by shadow method, single pole method and hypsometer.	2
5	Volume measurement of logs using various formulae.	2
6	Nursery lay out, seed sowing, vegetative propagation techniques.	4
7	Forest plantations and their management.	2
8	Visits of nearby forest based industries.	1

Reference Books

1. Diwivedi ,A.P. (1980). Forestry in India. Jugal Kishore and Comp. ,Dehradun
2. Negi, S.S.(1999). Agroforestry Handbook .International Book Distributer , Dehradun
3. S.P. Singh(2010).Favourate Agroforestry Trees .Agrotech Publishing Academy, Udaipur

ENG-111	Comprehension & Communication Skills in English	2(1+1)

Theory

War Minus Shooting- The sporting Spirit. A Dilemma – A layman looks at science Raymond B. Fosdick. You and Your English– Spoken English and broken English G.B. Shaw. Reading Comprehension, Vocabulary-Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

Practical

Listening Comprehension : Listening to short talks lectures, speeches (scientific, commercial and general in nature). Oral Communication: Phonetics, stress and intonation, Conversation practice. Conversation : rate of speech, clarity of voice, speaking and Listening, politeness & Reading skills: reading dialogues, rapid reading, intensive reading, improving reading skills. Mock Interviews: testing initiative, team spirit, leadership, intellectual ability. Group Discussions.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1.	War Minus Shooting- The sporting Spirit.	1
2.	A Dilemma – A layman looks at science Raymond B. Fosdick.	1
3.	You and Your English– Spoken English and broken English G.B. Shaw. Reading Comprehension,	1
4.	Vocabulary-Antonym, Synonym,	1
5.	Homophones, Homonyms, often confused words	1
6.	Exercises to Help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations.	1
7.	Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement	1
8.	Transformation, Synthesis,	1
9.	Direct and Indirect Narration.	1
10.	Written Skills: Paragraph writing,	1

11.	Precise writing, Report writing and Proposal writing.	1
12.	The Style: Importance of professional writing.	1
13.	Preparation of Curriculum Vitae and Job applications.	1
14.	Synopsis Writing.	1
15.	Interviews: kinds	1
16.	Importance and process.	1

Practical Schedule

S. N.	Title of Practical Exercise	Cr. Hrs.
1.	Listening Comprehension : Listening to short talks lectures	1
2.	speeches (scientific, commercial and general in nature).	1
3.	Oral Communication: Phonetics,	1
4.	stress and intonation,	1
5.	Conversation practice.	1
6.	Conversation : rate of speech, clarity of voice,	1
7.	Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement	1
8.	speaking and Listening, politeness	1
9.	Reading skills: reading dialogues,	1
10.	rapid reading,	1
11.	intensive reading,	1
12.	improving reading skills..	1
13.	Mock Interviews: test inginitiative,	1
14.	team spirit	1
15.	leadership, intellectual ability.	1
16.	Group Discussions	1

Reference Books

1. Thomson and Martinet (1995) "A Practical English Grammar, Exercies Books Vol. I & II " OUP Publication-
2. A.S. Hornby (1997) "*Advance Learner's Dictionary" OUP Publication.*
3. David Green (1990) *"Contemporary English Grammar Structure Composition"* McMillan.
4. Krishnamohan *"Speaking English Effectively"* McMillan.
5. Daniel Jones (1997) *" Drills and Tests in English Sounds"* ELBS

AGRON-111	Fundamentals of Agronomy	4(3+1)

Theory

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil plant water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, water logging.

Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, Effect of sowing depth on germination and seedling vigour, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield

contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill, Study of soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Measurement of irrigation water.

Lecture schedule - Theory

S. No.	Title of Topic	Cr. Hrs.
1	Agriculture-definition and importance of agriculture	1
2	Agronomy-meaning and scope of Agronomy	1
3	Types of seeds, dormancy of seeds	1
4	Viability of seeds, seed treatment	1
5	Sowing-methods, depth, plant density	1
6	Nursery bed and transplanting	1
7	Crop density and geometry	1
8	Optimum plant population	1
9	Tillage-definition and types of tillage including minimum and no tillage.	1
10	Tilth-definition and characteristics of good tilth.	1
11	Crop nutrition-essential nutrients-classification	1
12	Nutrient mobility in plants, Factors affecting nutrient availability	1
13	Functions and deficiency symptoms of primary nutrients	1
14	Manures –types, nutrient content ,	1
15	Green manures, compost	1
16	Fertilizers , INM	1
17	Nutrient use efficiency	1
18	Irrigation : definition and objectives	1
19	Water resources and irrigation development in India and Rajasthan.	1
20	Soil moisture constants and theories of soil water availability	1
21	Crop water requirement and factors affecting it	1
22	Scheduling of irrigation : meaning and different approaches for scheduling irrigation in field crops.	1
23	Surface methods of irrigation ; border , furrow , check basin and basin methods	1
24	Sprinkler and drip methods; their layout, adaptability , advantages and limitations.	1
25	Irrigation efficiency ; different terms used and their importance.	1
26	Water use efficiency -factors affecting and agronomic techniques to boost WUE	1
27	Irrigation water quality- different criteria and limits used, effect of poor quality water on plant growth .	1
28	Management practices for efficient use of poor quality waters including conjunctive use of water.	1

29	Agricultural drainage- definition, benefits and different methods of drainage.	1
30	Growth and development of crops,	1
31	factors affecting growth and development,	1
32	Plant ideotypes,	1
33	Crop rotation and its principles,	1
34	Adaptation and distribution of crops,.	1
35	Crop management technologies in problematic areas,	1
36	Harvesting and threshing of crops	1
37	Weeds – definition , harmful and beneficial effects and classification	1
38	Ecology of weeds	1
39	Weed - reproduction and seed dissemination	1
40	Crop-weed competition-concept and allelopathy	1
41	Concepts of weed prevention, eradication and weed control	1
42	Physical and cultural methods of weed control	1
43	Chemical and biological methods of weed control	1
44	Integrated weed management - An introduction	1
45	Introduction to herbicides, advantages and limitations of herbicides usages	1
46	Classification of herbicides	1
47	Herbicidal selectivity and resistance	1
48	Allelopathy	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1. 1	Identification of crops, seeds, fertilizers,	1
2. 2	Common Pesticides in agriculture	1
3. 3	Study of agro-climatic zones of India and Rajasthan	1
4. 4	Identification of weeds in crops	1
5. 5	Methods of herbicide and fertilizer application,	1
6. 6	Study of yield contributing characters and yield estimation,	1
7. 7	Seed germination and viability test	1
8. 8	Numerical exercises on fertilizer requirement of crops	1
9. 9	Plant geometry and plant population of various crops	1
10. 10	Herbicides requirement calculations and water requirement	1
11. 11	Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill,	1
12. 12	Study of soil moisture measuring devices	1

13. 13	Measurement of field capacity	1
14. 14	Determination of bulk density	1
15. 15	Determination of infiltration rate	1
16. 16	Measurement of irrigation water	1

Reference Books

1. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
2. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur
4. Reddy, T.Yellamanda and Reddy, G.H. Sankara. 2016. Principles of Agronomy (2nd edition) , Kalyani Publishers, Ludhiana
5. Reddy, S.R.2012. Principles of Crop Production (4th edition), Kalyani Publishers, Ludhiana.
6. Gupta , O.P. 2005. Weed Management: Principles and Practices (2nd Ed) Agribios (India) Jodhpur.
7. De, Gopal Chandra 1989, Fundamentals of Agronomy. Oxford & IBH Publishing Co., New-Delhi.
8. Michael, A.M. 1987. Irrigation - Theory and Practice, Vikas Publishing House Pvt. Ltd., New-Delhi.
9. Mishra, R.D. and Ahmed, M. 1987. Manual on Irrigation Agronomy, Oxford & IBH Publishing Co.Pvt..Ltd., New-Delhi.ngs
10. आर्य, आण्एल एवं कुरील, आ.एस. 2016- सस्य विज्ञान के सिद्धान्त, साइंटिफिक पब्लिशर्स, जोधपुर
11. पोरवाल, बी. एल., सिंह, पुष्पेन्द्र एवं शर्मा, डी. डी. 2000. सस्य विज्ञान के मूल तत्व, के. पी. प्रकाशन, उदयपुर

BIO-111	**Introductory Biology**	**2(1+1)**

Theory

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics. Binomial nomenclature and classification Cell and cell division. Morphology of flowing plants. Seed and seed germination. Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Practical

Morphology of flowering plants – root, stem and leaf and their modifications. Inflorescence, flower and fruits. Cell, tissues & cell division. Internal structure of root, stem and leaf. Study of specimens and slides. Description of plants - Brassicaceae, Fabaceae and Poaceae.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Introduction to the living world	1
2	Diversity and characteristics of life	1
3	Origin of life	1
4	Evolution and Eugenics.	1
5	Binomial nomenclature and classification	1
6	Introduction of cell & cell organelles	1
7	Structure and functions of cell organelles	1
8	Structure and functions of tissues	1
9	Cell division; Mitosis	1
10	Cell division: Meiosis	1

11	Morphology of flowing plants- General morphology, Root with their modifications	1
12	Morphology of flowing plants- Stem & Leaf with their modifications	1
13	Morphology of flowing plants- flower & fruit with their modifications	1
14	Seed and seed germination	1
15	Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae	1
16	Role of animals in agriculture	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Morphology of root and their modifications	1
2	Morphology of stem and their modifications	1
3	Morphology of leaf and their modifications	1
4	Morphology of flower and inflorescence with their modifications	1
5	Morphology of Fruit and their modifications	1
6	Description of plants related to family- Fabaceae and Poaceae	1
7	Introduction about microscope, its parts and functioning	1
8	Types of tissues with charts/diagrams and slides	1
9	Slide preparation related to mitosis	1
10	Slide preparation related to meiosis	1
11	Slide preparation related to internal structure of root	1
12	Slide preparation related to internal structure of stem	1
13	Slide preparation related to internal structure of leaf	1
14	Specimens of root, stem, leaf, flower, inflorescence and fruits	1
15	Specimen/ permanent slides of cell and cell divisions, anatomical aspects of flowering plant.	1
16	Description of plants related to family- Brassicaceae, Fabaceae	1

Reference Books

1. Saxena and Sarabhai. 1989. Text Book of Botany. Rastogi Publication, Meerut
2. Sahu, A.C. A text Book of Practical Botany. Kalyani Publisher, New Delhi
3. Sharma, O.P. Plant Taxonomy. Tata McGraw-Hill Education, New Delhi
4. Kaushik, M.P. 2003. Modern Text Book of Botany. Prakash Publication, Muzaffer Nagar (UP)
5. Pandey, B.P. 2001. Plant Anatomy. S. Chand & Company. Ltd, New Delhi
6. Bendre, A. & Kumar, A. 2012. A Text Book of Practical Botany, Vol I & II. Rastogi Publication, Meerut
7. Rastogi V.B. Organic Evolution. Rastogi Publication.

MATHS-111	Elementary Mathematics	2(2+0)

Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral.Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points and , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line to the given circle . Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of & from first principle,

Lecture Schedule – Theory

Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form (Simple problems based on it).

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

Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.

S. No.	Title of Topic	Cr. Hrs.
1.	Straight lines	1
2.	Distance formula	1
3.	section formula	1
4.	Change of axes	1
5.	Equation of co-ordinate axes, Equation of lines parallel to axes	1
6.	Slope intercept form of equation of line, Slope-point form of equation of line	1
7.	Two point form of equation of line, Intercept form of equation of line	1
8.	Normal form of equation of line, General form of equation of line,	1
9.	Point of intersection of two st. lines,	1
10.	Angles between two st. lines, Parallel lines, Perpendicular lines	1
11.	Angle of bisectors between two lines, Area of triangle and quadrilateral	1
12.	Circle: Equation of circle whose centre and radius is known, General equation of a circle,	1
13.	Equation of circle passing through three given points,	1
14.	Equation of circle whose diameters is line joining two points (x_1, y_1) (x_2, y_2)	1
15.	Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$	1
16.	Functions, Evaluation of Functions, Operations with functions	2
17.	Limits, continuity, $\lim_{x \to a} \frac{x^n - a^n}{x - a}$ $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$	4
18.	Problems on continuity	1
19.	Differentiation of & $x^n, e^x, \sin x$ & $\cos x$ from first principle	2
20.	differentiation of sum and product of functions	1
21.	Quotient Rule, function of functions	2
22.	Differentiation of function of functions, Parametric Equation	2
23.	Logarithmic differentiation	1
24.	Differentiation of Inverse Trigonometric functions	1
25.	Successive differentiation, Maxima and minima	2
26.	Integration Formulae	1
27.	Integration by Substitution	2

28.	Integration by Parts	2
29.	Definite Integration	1
30.	Area under curves	2
31.	Matrices, Matrix Addition, equality of matrices, square matrix, identity, null matrix	2
32.	Subtraction, Scalar Multiplication, Matrix Multiplication, Transpose of a Matrix	2
33.	Determinants	1
34.	Inverse up to 3rd order	2

Reference Books

1. D.C. Gokhroo and S.L. Bhargava (1986), Elementary Calculus, Jaipur Publishing House, Jaipur.
2. Mathematics Textbook for Class X (2018), NCERT, New Delhi.
3. Mathematics Textbook for Class XII (2018), NCERT, New Delhi.

AGHR-111	Agricultural Heritage	2(2+0)

Theory

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

Lecture Schedule – Theory

S.No.	Title of Topic	Cr. Hrs.
1	Introduction of Indian agricultural heritage	2
2	Ancient agricultural practices,	2
3	Relevance of heritage to present day agriculture	2
4	Past and present status of agriculture and farmers in society	3
5	Journey of Indian agriculture and its development from past to modern era;	3
6	Plant production and protection through indigenous traditional knowledge;	3
7	Crop voyage in India and world;	3
8	Agriculture -scope; Importance of agriculture and agricultural resources available in India;	2
9	Crop significance and classifications;	2
10	Classification of crops-botanical, agronomic, seasonal.	2
11	Classification of crops based on life span, special purposes i.e. cover, green manure, catch, trap, cash, soiling.	2
12	National agriculture setup in India;	2
13	Current scenario of Indian agriculture;	2
14	Indian agricultural concerns and future prospects.	2

Reference Books

1. ICAR 1989 Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi
2. Nene, Y.L. 2007. Glimpses of the Agricultural Heritage of India. Asian Agri- Histroy Foundation, Secunderabad, Andhra Pradesh.
3. Nene, Y.L., Saxena, R.C. and Choudhary, S.L. 2009. A Textbook on Ancient History of Indian Agriculture, Munshiram Manoharial Publishers Pvt. Ltd,
4. Nene, Y.L., Choudhary, S.L. and Saxena, R.C. 2010. Textbook on Ancient History of Indian Agriculture, Asian Agri-History Foundation.
5. D. Kumari, Manimuthu Veeral. 2014. Text Book on Agricultural Heritage of India. Agrotech Publishing Academy.
6. ICAR. Introductory Agriculture. ICAR e-course. Indian Council of Agricultural Research, New Delhi. (http://www.agrimoon.com/wp-content/uploads/Introductory-Agriculture.pdf)

EXCOM-111	Rural Sociology & Educational Psychology	2 (2+0)

Theory

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology: Definition, objectives, history, challenges and social ecology in Indian context, Rural society: Important characteristics, differences & Relationship between Rural and Urban societies., Social Groups: Meaning, Definition, Classification, Factors considered in formation and organization of groups. Social Stratification – Meaning, Definition, Functions, Forms of Social stratification. Culture concept - Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions - Meaning, Definition and their role in Agricultural Extension. Social Institution: Meaning, Definition, Major institutions in Rural society, Functions., Social Change & Development: Meaning, Definition, Nature of Social change and factors of social change. Social process- Meaning, Definition, types. Social Control- - Meaning, Definition, Need and Means of Social control.. Rural Leadership: concept and definition, types and roles of leaders in rural context; Methods of selection of leaders.

Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Cognitive skills, Personality- Meaning, Definition, Types, Factors influencing the Personality and Role of Personality in Agricultural Extension., Motivation; Meaning , Definition, Importance in extension, Theories of Motivation, Intelligence-Meaning, Definition, Types, Factors affecting intelligence..Teaching Learning Process process-Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics. Perception, Emotions.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
	Theory	
1	Sociology and Rural sociology: Definition and scope, its significance in agriculture extension,	1
2	Social Ecology: Definition, objectives, history, challenges and social ecology in Indian context,	1
3	Rural society: Important characteristics, differences & Relationship between Rural and Urban societies.,	1
4	Social Groups: Meaning, Definition, Classification, Factors considered in formation and organization of groups.	2

5	Social Stratification – Meaning, Definition, Functions, Forms of Social stratification.	2
6	Culture concept - Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions - Meaning, Definition and their role in Agricultural Extension.	2
7	Social Institution: Meaning, Definition, Major institutions in Rural society, Functions.,	2
8	Social Change & Development: Meaning, Definition, Nature of Social change and factors of social change.	2
9	Social process- Meaning, Definition, types.	2
10	Social Control-Meaning, Definition, Need and Means of Social control.	2
11	Rural Leadership: concept and definition, types and roles of leaders in rural context; Methods of selection of leaders.	2
12	Educational psychology: Meaning & its importance in agriculture extension.	1
13	Behavior: Cognitive, affective, psychomotor domain, Cognitive skills,	2
14	Personality- Meaning, Definition, Types, Factors influencing the Personality and Role of Personality in Agricultural Extension.	2
15	Motivation; Meaning , Definition, Importance in extension, Theories of Motivation,	2
16	Intelligence-Meaning, Definition, Types, Factors affecting intelligence.	2
17	Teaching Learning Process - Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics.,	3
18	Perception, Emotions	1

Reference Books

1. Chidambaram, J.B. 1973. Introductory rural sociology. New York, John Wilex and Sons.
2. Desai, A.R. 1978. Rural sociology in India. Bombay, Popular Prakashan, 5th Rev. ed.
3. Doshi, S.L. 2007. Rural sociology. Rawat Publishers, Delhi.
4. Jayapalan, N. 2002. Rural sociology. Altanic Publishers, New Delhi.
5. Sharma, K.L. 1997. Rural society in India. Rawat Publishers, Delhi.
6. Bhatia, H.R. 1965. A Text Book of Educational Psychology, Asia Publishing House, New Delhi.
7. Pujari, D. 2002. Educational Psychology in Agriculture, Agrotech Publishing Academy, Udaipur
8. Bhushan, V. and Sachdeva, D.R. 2010. An introduction to Sociology, Kitab Mahal , New Delhi.
9. Rao, C.N.S. 2015. Sociology, S.Chand & Company, New Delhi.
10. Maslow, A.H (1970) Motivation and personality. Harper and Row publishers , New York.

HVE-111	Human Value and Ethics	1 (1+0)

Theory

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
	Theory	
1	Values and Ethics-An Introduction. Goal and Mission of Life.	2
2	Vision of Life& Principles	1
3	Self Exploration. Self Awareness. Self Satisfaction	2
4	Decision Making	1
5	Motivation.	1
6	Sensitivity. Success. Selfless Service.	2
7	Case Study of Ethical Lives.	2
8	Positive Spirit. Body, Mind and Soul	2
9	Attachment and Detachment	1
10	Spirituality Quotient	1
11	Examination	1

Reference Books

1. Joshi madhuri (2017) Human values & ethics , kalyani publishers , New Delhi
2. Sharma d. k. & Surendra Kumar, (2017) Manav Mulya avam neetiyan (Human values & Ethics) , Rama publishing House, Meerut
3. Nagarazan, R S, (2018) A text book of Human values & ethics , II edition New age International publishers , New Delhi

II. NON-GRADIAL COURSES

1. NSS/NCC/Physical Education & Yoga Practices 2(0+2)

Theory

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

Following activities are to be taken up under the NSS course:

- Introduction and basic components of NSS: Orientation
- NSS programmes and activities
- Understanding youth
- Community mobilisation
- Social harmony and national integration
- Volunteerism and shramdan
- Citizenship, constitution and human rights
- Family and society
- Importance and role of youth leadership
- Life competencies
- Youth development programmes
- Health, hygiene and sanitation
- Youth health, lifestyle, HIV AIDS and first aid

- Youth and yoga
- Vocational skill development
- Issues related environment
- Disaster management
- Entrepreneurship development
- Formulation of production oriented project
- Documentation and data reporting
- Resource mobilization
- Additional life skills
- Activities directed by the Central and State Government

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

SYLLABUS

Semester I

Course Title: National Service Scheme I

Introduction and basic components of NSS:

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

NSS programmes and activities

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth

Definition, profile, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community mobilisation

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership

Social harmony and national integration

Indian history and culture, role of youth in nation building, conflict resolution and peace-building

Volunteerism and shramdan

Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism

Citizenship, constitution and human rights

Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society

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

Semester I:National Cadet Corps

1. Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
2. Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
3. Sizing, numbering, forming in three ranks, open and close order march and dressing.
4. Saluting at the halt, getting on parade, dismissing and falling out.
5. Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear.
6. Turning on the march and wheeling. Saluting on the march.
7. Marking time, forward march and halt.
8. Changing step, formation of squad and squad drill.
9. Command and control, organization, badges of rank, honours and awards
10. Nation Building- cultural heritage, religions, traditions and customs of India. National integration.
11. Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
12. Leadership traits, types of leadership. Character/personality development.
13. Civil defense organization, types of emergencies, fire fighting, protection,
14. Maintenance of essential services, disaster management, aid during development projects. 15. Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
16. Structure and function of human body, diet and exercise, hygiene and sanitation.
17. Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
18. Adventure activities
19. Basic principles of ecology, environmental conservation, pollution and its control.
20. Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self defense.

Physical Education and Yoga Practices **Credit hours: 2(0+2)**

Semester I: Physical Education and Yoga Practices

1. Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
2. Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
3. Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game
4. Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
5. Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation
6. Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game
7. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
8. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
9. Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
10. Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation
11. Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
12. Teaching of some of Asanas – demonstration, practice, correction and practice

13. Teaching of some more of Asanas – demonstration, practice, correction and practice
14. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
15. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
16. Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
17. Teaching – Meaning, Scope and importance of Physical Education
18. Teaching – Definition, Type of Tournaments
19. Teaching – Physical Fitness and Health Education
20. Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

B. Sc.(Hons.) Agriculture, Part-I

II Semester

GPB-121	Fundamentals of Genetics	3(2+1)

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Cell division – mitosis, meiosis, Probability and Chi-square. Dominance relationships, gene interaction. Multiple alleles, pleiotropism and pseudoalleles. Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping.

Structural changes in chromosome, Numerical changes in chromosome, Proof for DNA as genetic material and Genetic code, Mutation, classification, Methods of inducing mutation & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Epistatic interactions with examples. Cytoplasmic inheritance. Genetic disorders.

Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practical

Study of microscope. Study of cell structure. stains and fixatives, 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 structure.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Pre and Post Mendelian concepts of heredity	1
2	Mendelian principles of heredity	1
3	Cell division – mitosis	1
4	Cell division – meiosis	1
5	Probability and Chi-square	1
6	Dominance relationships and gene interaction	1

7	Epistatic gene interactions with examples (complementary, supplementary, duplicate gene interactions)	1
8	Epistatic gene interactions with examples (masking, inhibitory, polymeric and additive gene interactions)	1
9	Pleiotropism, pseudoalleles, Multiple alleles and Blood group genetics	1
10	Sex determination	1
11	Sex limited, sex influenced and sex linked traits	1
12	Sex linkage	1
13	Linkage and its estimation	1
14	Crossing over : introduction & mechanisms	1
15	Chromosome mapping	1
16	Structural changes in chromosome	1
17	Numerical changes in chromosome	1
18	Mutation: introduction, characteristics & classification	1
19	Mutagenic agents: physical and chemical mutagens	1
20	Induction of mutation, Methods of inducing mutation & CIB technique	1
21	Qualitative & Quantitative traits, Polygenes and continuous variations	1
22	Multiple factor hypothesis	1
23	Cytoplasmic inheritance	1
24	Genetic disorders	1
25	Nature, structure and types of genetic material	1
26	Proof for DNA as genetic material	1
27	Replication of genetic material	1
28	Genetic code & Protein synthesis	1
29	Transcription mechanism of genetic material	1
30	Translational mechanism of genetic material	1
31	Gene concept: Gene structure and function	1
32	Gene regulation, operon concept, Lac and Trp operons	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Study of microscope: parts and types	1
2	Study of cell structure	1
3	Experiments on monohybrid, test cross and back cross	1
4	Experiments on dihybrid, test cross and back cross	1
5	Experiments on trihybrid, test cross and back cross	1
6	Experiments on epistatic interactions including test cross and back cross	1
7	Experiments on epistatic interactions including test cross and back cross	1
8	Stains and their preparation	1

9	Fixatives and their preparation	1
10	Practice on mitotic cell division	1
11	Practice on meiotic cell division	1
12	Experiments on probability	1
13	Experiments on Chi-square test	1
14	Determination of linkage and cross over analysis (through two point test cross and three point test cross data)	1
15	Study on sex linked inheritance in Drosophila	1
16	Study of models on DNA and RNA structure	1

Reference Books

1. Gupta P.K.2004. Cytology, Genetics and evolution. Rastogi Publications, Meerut. (Hindi Edition)
2. Klug, W.W.and Cummings, M.R.2005.Concepts of genetics Pearson Education (Singapore) pvt. Ltd., Indian Branch, Pratap Ganj, New Delhi.
3. Singh, B.D. 2001.Kalyani Publishing House, New Delhi.
4. Strickberger, M.W.2001.Genetics. Prentice Hall of India. Pvt. Ltd., New Delhi.

SSAC-121	Agricultural Microbiology (Course to be shared with Plant Pathology)	2(1+1)

Theory

Introduction to microbial world: Prokaryotic and eukaryotic microbes. Sterilization, disinfection, pasteurization and Koch's postulates. Bacteria: cell structure, growth, Gram positive and Gram negative bacteria, chemoautotrophy and photoautotrophy. Bacterial genetics: Genetic recombination: transformation, conjugation and transduction, plasmids, transposon. Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation: symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, bio-fertilizers, bio-pesticides, bio-fuel production and biodegradation of agro-wastes.

Practical

Introduction to microbiology laboratory and its equipments. Microscope: parts, principles of microscopy, resolving power and numerical aperture. Methods of sterilization. Nutritional media and their preparations. Methods of isolation and purification of microbial cultures. Isolation of Rhizobium, Azotobacter and BGA. Staining and microscopic examination of microbes. Enumeration of microbial population in soil- bacteria, fungi and actinomycetes.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Introduction to microbial world: Prokaryotic and eukaryotic microbes.	1
2.	Sterilization, disinfection and pasteurization and Koch's postulates.	1
3.	Bacteria: cell structure, growth, Gram positive and Gram negative bacteria, chemoautotrophy and photoautotrophy.	2
4.	Bacterial genetics: Genetic recombination: transformation, conjugation and transduction, plasmids, transposon.	3
5.	Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles.	3

6.	Biological nitrogen fixation: symbiotic, associative and asymbiotic.	2
7.	Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere.	1
8.	Microbes in human welfare: silage production,	1
9.	Bio-fertilizers, bio-pesticides and bio-fuel production	1
10.	Biodegradation of agro-wastes.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Introduction to microbiology laboratory and its equipments.	1
2.	Microscope: parts, principles of microscopy, resolving power and numerical aperture.	2
3.	Methods of sterilization.	1
4.	Nutritional media and their preparations.	3
5.	Methods of isolation and purification of microbial cultures.	3
6.	Isolation of *Rhizobium, Azotobacter* and BGA..	2
7.	Staining and microscopic examination of microbes.	2
8.	Enumeration of microbial population in soil- bacteria, fungi and actinomycetes	2

Reference Books

1. Biswas, T.D. and Mukherjee, S.K. 1990. Text Book of Soil Sciences, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. Mukherjee, N. and Ghosh T. 1998. Agricultural Microbiology, Kalyani Publishers, New Delhi.
3. Pelczar, Jr. Michel J. Chan, E.C.S. and Krieg, Noel R. 1997. Microbiology. Tata McGraw -Hill Edition, 1993. India.
4. Rangaswami, G. and Bagyaraj, D.J. 1993. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi.
5. Rao, N.S. 2000. Soil Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Vishunavat, K. and Kolte, S.J. 2005. Essentials of Phytopathological Techniques. Kalyani Publishers, New Delhi
7. Sharma, P.D. 2010. Microbiology. 3rd edition Rastogi Publishers, Meerut
8. Dube H.C. 2007. A Text Book of Fungi, Bacteria & Viruses. 3rd ed. Agrobios India, Jodhpur.
9. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.

AGENGG-121	Introductory Soil and Water Conservation Engineering	2(1+1)

Theory

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Soil Loss Equation. Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways. Water harvesting and its techniques. Wind erosion - principle of wind erosion control and its control measures. Familiarization with centrifugal pumps, measurement of irrigation water, water conveyance system and familiarization with pressurized irrigation methods.

Practical

General status of soil conservation in India and Rajasthan. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of contour bunds. Design of graded bunds. Problem on wind erosion. Numerical problems on friction head, velocity head, total head and horse power calculation of pumps. Measurement of irrigation water in the field by different methods and related numerical. Study of components of drip and sprinkler system. Study of watershed area.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Introduction to Soil and Water Conservation and causes of soil erosion	1
2	Definition and agents of soil erosion and water erosion	1
3	Forms of soil erosion-rain drop, sheet, rill and gully erosion: factor affecting soil erosion.	1
4	Gully classification and control measures.	1
4	Soil loss estimation by universal Soil Loss Equation.	1
5	Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways.	2
6	Water harvesting and its techniques.	1
7	Wind erosion- principle of wind erosion and its control measures	1
8	Centrifugal pumps- volute and diffuser types; Principle of operation of centrifugal pumps.	1
9	Pump related terms- capacity, suction lifts, suction heads, discharge heads, friction head, pressure head, total head, velocity head, net positive suction head, maximum practical suction lift of pumps, water horsepower, shaft horse power, pump efficiency, brake horsepower.	2
10	Measurement of irrigation water- volume method, velocity- area methods, water meter, weirs- rectangular, cipolletti, 90° v- notch.	2
11	Drip irrigation method- Adoptability, limitation, components and layout.	1
12	Sprinkler irrigation method- adoptability, limitations, types, components and layout.	1

Practical Schedule

S. No	Title of Practical Exercise	Cr. Hrs.
1.	General status of soil conservation in India and Rajasthan	1
2.	Calculation of erosion index	1
3.	Estimation of soil loss.	2
4.	Preparation of contour maps	2
5.	Numericals on design of contour bunds	2
6.	Numerical problems on friction head, velocity head, total head and horse power calculation of pumps.	2
7.	Measurement of irrigation water in the field by different methods and related numericals.	2
8.	Study of different components of drip irrigation system	1
9.	Study of different components of sprinkler irrigation system	1
10.	Visit to nearby watersheds	2

Reference Books

1. Land and Water Management Engineering. 1982. Murthy V.V.N. Kalyani Pubhliers, New Delhi.
2. Irrigation: Theory and Practices.2012. Michael A.M. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Principles of Agricultural. Engineering. Vol. II. 2012. Michael A.M. and T.P. Ojha. Jain Brothers, New Delhi.
4. Soil and Water Conservation Water Management. 2010. Mahnot, S.C., Singh P.K. and Chaplot, P.C.,. Apex Publication House, Udaipur.

CPHYS-121	Fundamentals of Crop Physiology	2(1+1)

Theory

Introduction to crop physiology and its importance in Agriculture. Plant cell: an Overview, Diffusion and osmosis, Absorption of water, transpiration and Stomatal Physiology. Mineral nutrition of Plants; functions and deficiency symptoms of nutrients and nutrient uptake mechanisms. Photosynthesis; Light reaction and Dark reactions:C3, C4 and CAM plants. Respiration; Glycolysis, TCA cycle and electron transport chain. Physiology of flowering. Plant growth regulators; physiological roles and agricultural uses. Physiological aspects of growth and development of major crops. Growth analysis. Role of Physiological growth parameters in crop productivity.

Practical

Preparation of solutions and buffers. Demonstration of the process of osmosis, plasmolysis, root pressure in plants. Measurement of transpiration rate using Ganongs potometer. Estimation of relative water content in plants. Visual symptoms of nutrient deficiency in plants. To study structure and distribution of stomata in leaf. Separation of photosynthetic pigments through paper chromatography. To demonstrate that O2 is evolved during photosynthesis and light and CO2 is essential for photosynthesis using Molls half leaf experiment. Measurement of photosynthetic CO2 assimilation by Infra Red Gas Analyzer (IRGA. Demonstration of anaerobic respiration. Measurement of respiration quotient, plant growth by Arc auxanometer and growth analysis parameters.

Lecture Schedule -Theory

S. No.	Title of Topic	Cr. Hrs.
1	Introduction to crop physiology and its importance in Agriculture	1
2	Plant cell: an Overview	1
3	Diffusion and osmosis, Absorption of water, transpiration and Stomatal Physiology	2
4	Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients and nutrient uptake mechanisms	2
5	Photosynthesis: Light reaction	1
6	Dark reactions:C_3, C_4 and CAM plants	1
7	Respiration; Glycolysis	1
8	TCA cycle and electron transport chain	1
9	Physiology of flowering	1
10	Plant growth regulators: Physiological roles and agricultural uses	2
11	Physiological aspects of growth and development of major crops	1
12	Growth analysis, Role of Physiological growth parameters in crop productivity	2

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	To prepare solutions and buffers	1
2	To demonstrate the process of osmosis	1
3	To demonstrate the process of plasmolysis	1
4	To measure the root pressure in plants	1
5	To measure the rate of transpiration using Ganongs potometer	1
6	Estimation of relative water content in plants	1
7	Visual symptoms of nutrient deficiency in plants	1
8	To study structure and distribution of stomata in leaf	1
9	Separation of photosynthetic pigments through paper chromatography	1
10	To demonstrate that O_2 is evolved during photosynthesis	1
11	To demonstrate that light and CO_2 is essential for photosynthesis using Molls half leaf experiment	1
12	Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyzer (IRGA)	1
13	To demonstrate anaerobic respiration	1
14	Measurement of respiration quotient	1
15	Measurement of plant growth by Arc auxanometer	1
16	Measurement of growth analysis parameters	1

Reference Books

1. S. N. Pandey and B. K. Sinha.1977.Plant Physiology. Vikas Publishing House Pvt. Ltd, New Delhi.
2. A. Kumar and S.S.Purohit.1998. Plant Physiology Fundamental and Application. Agrobotanica 4E 176 J.N. Vyas Nagar, Bikaner.
3. N.K. Gupta and S. Gupta. 2005. Plant Physiology. Oxford & IBH, New Delhi.
4. M.Bala,S.Gupta and N.K.Gupta.2013.Practicals in Plant Physiology. Scientific publisher, Jodhpur.
5. D.L.Bagdi. 2016.Crop Physiology. New India Publishing Agency, New Delhi.

AGECON-121	Fundamentals of Agricultural Economics	2(2+0)

Theory

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. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. 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, 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. 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 markets. Price determination under perfect competition in short run. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance,

concepts of national income accounting and approaches to measurement. Population: Importance, Malthusian population theory, current policies and programmes on population control. Money meaning and functions of money, general price index, inflation and deflation. Banking: types of banks, functions of commercial Bank. Tax: meaning, direct and indirect taxes, agricultural taxation, VAT & GST. Economic systems: meaning of capitalistic, socialistic and mixed economies.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	*Economics:* Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis.	2
2	Nature of economic theory; rationality assumption, concept of equilibrium.	1
3	Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.	2
4	Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development.	1
5	*Demand:* meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle.	2
6	Consumer's equilibrium, concept of consumer surplus.	1
7	Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.	2
8	Production: process, creation of utility, factors of production, input output relationship.	2
9	*Laws of returns*: Law of variable proportions and law of returns to scale. *Cost:* Cost concepts, short run and long run cost curves.	2
10	Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.	2
11	Market structure: meaning and types of market, basic features of perfectly competitive markets.	1
12	Price determination under perfect competition in short run.	1
13	Distribution theory: meaning, factor market and pricing of factors of production.	1
14	Concepts of rent, wage, interest and profit.	1
15	*National income:* Meaning and importance, concepts of national income accounting and approaches to measurement.	2
16	Population: Importance, Malthusian population theory, current policies and programmes on population control.	2
17	Money- meaning and functions of money, general price index, inflation and deflation.	2
18	Banking: types of banks, functions of commercial Banks.	1
19	*Tax:* meaning, direct and indirect taxes, agricultural taxation, VAT & GST.	2
20	*Economic systems:* meaning of capitalistic, socialistic and mixed economies.	2

Reference Books

1. K.K. Dewett and J.D. Verma (1986) Elementary Economic Theory, S. Chand & Company, New Delhi
2. S.K. Mishra and V.K. Puri (1996) Indian Economy, Himalaya Publishing House, New Delhi
3. G.B. Jakhar and S.G. Beri (1996) Elementary Principles of Economics, Oxford University Press (10th Edition), Delhi
4. Berkeley Hill (1980) An Introduction to Economics for students of agriculture, Pergaman Press, Oxford
5. B.L. Gupta (1996) Introduction to Economic Theory, Arya Book Depot, New Delhi

PPATH-121	Fundamentals of Plant Pathology	3(2+1)

Theory

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Causes and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

Fungi: general characters, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, classification of fungi (key to Domain to Phylum).

Bacteria and mollicutes: general morphological characters, reproduction and classification of plant pathogenic bacteria. Viruses: nature, structure and transmission.

Nematodes: General morphology, outline of classification, symptoms and nature of damage caused by plant nematodes (Heterodera, Meloidogyne and Anguina).

Role of enzymes and toxins in disease development. Defense mechanism in plants.

Practical

Acquaintance with various laboratory equipments and microscopy. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Identification of plant parasitic nematodes (Heterodera, Meloidogyne and Anguina). Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Importance of plant diseases, scope and objectives of Plant Pathology	1
2	History of Plant Pathology with special reference to Indian work.	3
3	Terms and concepts in Plant Pathology	3
4	Pathogenesis.	2
5	Causes and classification of plant diseases.	1
6	Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vascular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them.	3
7	Diseases and symptoms due to abiotic causes.	1
8	**Fungi:** General characters, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus,	2

9	**Fungi:** Reproduction (asexual and sexual).	1
10	**Fungi:** Nomenclature, Binomial system of nomenclature, classification of fungi (key to Domain to Phylum).	3
11	**Bacteria and mollicutes:** General morphological characters, reproduction and classification of plant pathogenic bacteria.	2
12	Classification of plant pathogenic bacteria.	2
13	**Viruses:** nature, structure and transmission.	2
14	**Nematodes:** General morphology, outline of classification,	2
15	**Nematodes:** Symptoms and nature of damage caused by plant nematodes (*Heterodera, Meloidogyne* and *Anguina*).	2
16	Role of enzymes and toxins in disease development.	1
17	Defense mechanism in plants.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Acquaintance with various laboratory equipments and microscopy	2
2	Preparation of media and isolation	2
3	Koch's postulates	1
4	General study of different structures of fungi	1
5	Study of symptoms of various plant diseases	2
6	Staining and identification of plant pathogenic bacteria	2
7	Transmission of plant viruses	2
8	Identification of plant parasitic nematodes (Heterodera, Meloidogyne and Anguina)	2
9	Sampling and extraction of nematodes from soil and plant material and preparation of nematode mounting	2

Reference Books

1. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
2. Alexopolus, C.J., Mims, C.W. and Blackwell, M. 2013. Introductory Mycology. John Wiley Estern Private Limited, New York.
3. Mehrotra, R.S. and Agrawal, A. 2013. Plant Pathology. 2nd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Singh, R.S. 2011. Introduction to Principles of Plant Pathology. 4th ed. Oxford & IBH Publishing Company. New Delhi.
5. Nene Y.L. and Thapliyal, P.N. 2011. Fungicides in Plant Diseases Control. 3rd Ed. Oxford & IBH published Co. Pvt. Ltd. New Delhi.
6. Dube H.C. 2007. A Text Book of Fungi, Bacteria & Viruses. 3rd ed. Agrobios India, Jodhpur.
7. Dube, H.C. 2012, Modern Plant Pathology, 2nd ed. Agrobios (India), Jodhpur
8. Dube, H.C. 2013, An Introduction to Fungi. 4th ed. , Scientific Publishers India, Jodhpur.

ENTO-121	Fundamentals of Entomology	3(2+1)

Theory

Part - I

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Major sensory organs like simple and compound eyes, chemoreceptor. Metamorphosis in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretary (endocrine) and reproductive system, in insects. Types of reproduction in insects.

Part-II

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Gryllidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Bombycidae; Coleoptera: Coccinellidae, Gelerucidae, Cerambycidae, Curculionidae, Bruchidae, Melonthidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Cockroach; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

Lecture Schedule-Theory

S.No.	Title of Topic	Cr. Hrs.
1	History of Entomology in India.	1
2	Major points related to dominance of Insecta in Animal kingdom.	1
3	Classification of phylum Arthropoda upto classes.	1
4	Structure and functions of insect cuticle and molting.	1
5	**Morphology of grasshopper:** Body segmentation- structure of head, thorax and abdomen.	2
6	Structure and modifications of insect antennae.	1
7	Structure and modifications of insect mouth parts.	3
8	Structure and modifications of insect leg.	1
9	Wing venation, modifications and wing coupling apparatus.	1

10	Structure of genital organs and sensory organs (simple and compound eyes, chemoreceptor).	2
11	Metamorphosis in insects, types of larvae and pupae.	1
12	Structure and functions of digestive system.	1
13	Structure and functions of circulatory and excretory system.	2
14	Structure and functions of respiratory system.	1
15	Structure and functions of nervous system.	1
16	Structure and functions of secretory (endocrine) system	1
17	Structure and functions of reproductive system and types of reproduction in insects.	2
18	**Taxonomy**- importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order.	2
19	Orthoptera: Acrididae, Gryllidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae. Thysanoptera: Thripidae.	2
20	Hemiptera: Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae.	1
21	Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Bombycidae.	1
22	Coleoptera: Coccinellidae, Galerucidae, Cerambycidae, Curculionidae, Bruchidae, Melonthidae.	1
23	Hymenoptera: Tenthridinidae, Apidae, Trichogrammatidae, lchneumonidae, Braconidae, Chalcididae.	1
24	Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae; Neuroptera: Chrysopidae.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Methods of collection and preservation of insects including immature stages.	1
2	External features of Grasshopper/Cockroach.	1
3	Types of insect antennae, mouthparts and legs.	4
4	Wing venation, types of wings and wing coupling apparatus.	1
5	Dissection of digestive system in insects (Grasshopper/ Cockroach)	1

6	Dissection of male and female reproductive systems in insects (Grasshopper/ Cockroach).	1
7	Study of characters of orders Orthoptera, Dictyoptera with their families.	1
8	Study of characters of orders Odonata, Isoptera, Thysanoptera with their families.	1
9	Study of characters of order Hemiptera with its families.	1
10	Study of characters of order Lepidoptera with its families.	1
11	Study of characters of order Coleoptera with its families.	1
12	Study of characters of order Diptera with its families.	1
13	Study of characters of orders Hymenoptera and Neuroptera with their families.	1

Reference Books

1. Chapman .R.F.1981. Insect Structure and Function, ELBS Publishers New Delhi.
2. David B.V. and Ananthakrishnan .T.N. 2003. General and Applied Entomology, 2nd Ed. Mc graw Hill publishing Co. Ltd. New Delhi.
3. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
4. Pant. N.C. and Ghai, S. 1981. Insect Physiology and Anatomy, ICAR, New Delhi.
5. Richards O.W. and Davies R.G. 1977. Imm's General Text Book of Entomology, Vol. I & II. Chapman and Hall, London.
6. Snodgrass R.E .2001. Principles of Insect Morphology, CBS Publishers and Distributors, New Delhi.

EXCOM-121	Fundamentals of Agricultural Extension Education	3(2+1)

Theory

Education: Meaning, definition & Types; 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 (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.). Post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); Various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, NARP, ATIC,RKVY, Pradhan Mantri Fasal Bima Yojana, Soil Health Card, NRLM etc.)

New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.. Rural Development: Concept, meaning, definition; various rural development programmes launched by Govt. of India. T & V System,SGSY, ICDS, IRDP, NHM,MNREGA, Rajiv Ganghi Scheme for empowerment of Adolesenct girls / Boys, Gramin Bhandaran Yojana, Pradhan Mantri Adarsh Gram yojana, Pradhan Mantri Kaushal Vikas yojana,

Community Development-meaning, definition, concept & principles, Philosophy of C.D, Panchayati Raj System.Extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes;Transfer of technology: concept and models, capacity building of extension personnel; Training: Types , planning a training Programme. Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

To get acquainted with university extension system. Group discussion- exercise; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of 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; exposure to mass media.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Education: Meaning, definition & Types;	**1**
2	Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education;	**3**
3	Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development.	**2**
4	Extension systems in India: Extension efforts in Pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.).	**3**
5	Post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.);	**2**
6	Various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, NARP, ATIC,RKVY, Pradhan Mantri Fasal Bima Yojana, Soil Health Card, NRLM etc.)	**6**
7	New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc..	**3**
8	Rural Development: Concept, meaning, definition; various rural development programmes launched by Govt. of India. ICDS, IRDP, NHM,MNREGA, Rajiv Gandhi Scheme for empowerment of Adolescent girls / Boys, Gramin Bhandaran Yojana, Pradhan Mantri Adarsh Gram yojana, Pradhan Mantri Kaushal Vikas yojana,	**5**
9	Community Development-meaning, definition, concept & principles, Philosophy of C.D,	**1**
10	Panchayati Raj System.	**1**
11	Extension administration: meaning and concept, principles and functions.	**1**
12	Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes;	**1**
13	Transfer of technology: concept and models, capacity building of extension personnel;	**1**
14	Training: Types, planning training Programme.	**1**
15	Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.	**1**

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	To get acquainted with university extension system.	**1**
2	Group discussion- exercise;	**1**
3	Preparation and use of AV aids,	**4**
4	Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories;	**4**
5	A visit to village to understand the problems being encountered by the villagers/ farmers;	**1**
6	To study organization and functioning of development departments at district level;	**1**
7	Visit to NGO and learning from their experience in rural development;	**1**
8	Understanding PRA techniques and their application in village development planning;	**2**
9	Exposure to mass media.	**1**

Reference Books

1. Adivi Reddy, A., 2001, Extension Education, Sree Lakshmi press, Bapatla.
2. Dahama, O. P. and Bhatnagar, O. P., 1998, Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

3. Jalihal, K. A. and Veerabhadraiah, V., 2007, Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
4. Muthaiah Manoraharan, P. and Arunachalam, R., Agricultural Extension, Himalaya Publishing House (Mumbai).
5. Rathore, O. S. et al., 2012, Handbook of Extension Education, Agrotech Publishing Academy, Udaipur.
6. Ray, G. L., 1991 (1st Edition), Extension Communication and Management, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
7. Supe, S. V., 2013 (2nd Edition), A Text Book of Extension Education, Agrotech Publishing Academy, Udaipur.
8. Van Den Ban, A. W. and Hawkins, H. S., Agricultural Extension, S. K .Jain for CBS Publishers & Distributors, New Delhi.
9. Debabrata Das Gupta. Extension Education. Agrobios (India), Agro house behind Nasrani Cinema, Chaupasani Road, Jodhpur- 342402, Phone -0291-2642319, Fax- 0291-2643993, Email- agrobios@sify.com
10. Sharma, O. P. & Somani, L. L. 2012. Dimension of Agricultural Extension, Agroteh Publishing Academy. Udaipur.

CSPD-121	Communication Skills and Personality Development	2(1+1)

Theory

Communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences. Soft Skills. Extension teaching methods: meaning, classification, individual, group and mass contact methods. ICT Applications in TOT (New and Social Media), media mix strategies;

Practical

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations. Handling and use of audio visual equipments and digital camera and LCD projector; Group discussion- exercise; Presentation skills exercise; micro teaching exercise; Script writing, writing for print and electronic media, developing script for radio and television. Visit to community radio.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication.	**2**
2	Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication;	**1**
3	Listening and note taking,	**1**
4	Writing skills, oral presentation skills;	**1**
5	Field diary and lab record; indexing, footnote and bibliographic procedures.	**1**
6	Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting;	**2**
7	Individual and group presentations, impromptu presentation, public speaking;	**2**
8	Group discussion. Organizing seminars and conferences.	**2**
9	Soft Skills.	**1**

10	Extension teaching methods: meaning, classification, individual, group and mass contact methods.	**2**
11	ICT Applications in TOT (New and Social Media), media mix strategies;	**1**

Practical Schedule

S. No	Title of Practical Exercise	Cr. Hrs.
1	Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.	**3**
2	Reading and comprehension of general and technical articles,	**1**
3	Precise writing, summarizing, abstracting; individual and group presentations.	**2**
4	Handling and use of audio visual equipments and digital camera and LCD projector;	**4**
5	Group discussion- exercise;	**1**
6	Presentation skills exercise;	**1**
7	Micro teaching exercise;	**1**
8	Script writing, writing for print and electronic media, developing script for radio and television.	**2**
9	Visit to community radio.	**1**

Reference Books

1. Sandhu, A. S. (1999). Textbook on Agricultural Communication; process and methods oxford RIBH Publishing co. Pvt. Ltd. New Delhi.
2. Berlo, David K. (1960). The process of Communication. Nw Yark, Holt, Rinehart and Winston Inc.
3. Dahama, O. P. and Bhatnagar, O.P., 1998, Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
4. Jalihal, K. A. and Veerabhadraiah, V., 2007, Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
5. Ray, G. L., 1991 (1st Edition), Extension Communication and Management, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
6. Supe, S. V., 2013 (2nd Edition), A Text Book of Extension Education, Agrotech Publishing Academy, Udaipur.
7. M Hilaris 2011. Indian agriculture and information and communication technology (ICT): Soundari, New century Publications, Carnegie,
8. Dale. 2012. How to Win Friends and Influence People in the Digital Age. Simon & Schuster.
9. Covey Stephen R. 1989. TheSeven Habits of Highly Successful People. Free Press.
10. Verma, K.C. 2013. The Art of Communication. Kalpaz.
11. Mohan Krishna and Meera Banerjee. 1990. Developing Communication Skills. Macmillan India Ltd. New Delhi.
12. Sharma R C and Krishna Mohan. 1978. Business Correspondence. Tata Mc Graw Hill
13. Adivi Reddy, A., 2001, Extension Education, Sree Lakshmi press, Bapatla.

AGRON-121	Introductory Agro-meteorology & Climate change	2(1+1)

Theory

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, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification;

Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting-types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

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

Lecture schedule - Theory

S. No	Title of Topic	Cr. Hrs.
1	Meaning and scope of agricultural meteorology	1
2	Earths atmosphere- its composition, extent and structure	1
3	Atmospheric weather variables; Atmospheric pressure, its variation with height	1
4	Wind, types of wind, daily and seasonal variation of wind speed	1
5	Cyclone, anticyclone, land breeze and sea breeze	1
6	Nature and properties of solar radiation, solar constant, depletion of solar radiation	1
7	Short wave, longwave and thermal radiation, net radiation, albedo	1
8	Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature,	1
9	Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure,	1
10	Process of condensation, formation of dew, fog, mist, frost, cloud	1
11	Precipitation- process , types such as rain, snow, sleet, and hail	1
12	Cloud formation and classification; Artificial rainmaking, Monsoon- mechanism and importance in Indian agriculture	1
13	Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave	1
14	Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production	1
15	Weather forecasting- types of weather forecast and their uses	1
16	Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Visit of Agrometeorological Observatory, site selection of observatory, exposure of instruments and weather data recording.	2
2.	Measurement of total, shortwave and longwave radiation, and its estimation using Planck's intensity law.	2

3.	Measurement of albedo and sunshine duration, computation of Radiation Intensity using BSS.	2
4.	Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis.	1
5.	Measurement of soil temperature and computation of soil heat flux.	1
6.	Determination of vapor pressure and relative humidity.	1
7.	Determination of dew point temperature.	1
8.	Measurement of atmospheric pressure and analysis of atmospheric conditions.	1
9.	Measurement of wind speed and wind direction, preparation of windrose.	1
10.	Measurement, tabulation and analysis of rain.	1
11.	Measurement of open pan evaporation and evapotranspiration.	1
12.	Computation of PET and AET.	2

Reference Books

1. Sacheti,A.K. 1985. Agricultural Meteorological Instructional Cum Practical Manual (Ed.) NCERT Publication, New Delhi.
2. Lal, D.S. 2005 Climatology, Sharda Pustak Bhawan, Allahabad..
3. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology. ICAR, New-Delhi.
4. Sahu, D.D., 2007. Agrometeorology and Remote sensing: Principles and Practices , Agrobios (India) , Jodhpur.
5. Murithy, K, and Radha, V. 1995. Practical Manual on Agricultural Meteorology , Kalyani Publishers, New-Delhi
6. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
7. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy, Agrobios (India), Jodhpur
8. पोरवाल, बी. एल., सिंह, पुष्पेन्द्र एवम् शर्मा, डी. डी. 2000. सस्य विज्ञान के मूल तत्व, के. पी. प्रकाशन, उदयपुर

Course Title: National Service Scheme II

Importance and role of youth leadership

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

Life competencies

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

Youth development programmes

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

Health, hygiene and sanitation

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

Youth health, lifestyle, HIV AIDS and first aid

Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga

History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

Semester II: National Cadet Corps

1. Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
2. Shoulder from the order and vice-versa, present from the order and vice-versa.
3. Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice-versa.
4. Guard mounting, guard of honour, Platoon/Coy Drill.
5. Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
6. Loading, cocking and unloading. The lying position and holding.
7. Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
8. Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
9. Characteristics of Carbine and LMG.
10. Introduction to map, scales and conventional signs. Topographical forms and technical terms.
11. The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
12. Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
13. Knots and lashings, Camouflage and concealment, Explosives and IEDs.
14. Field defenses obstacles, mines and mine lying. Bridging, watermanship
15. Field water supplies, tracks and their construction.
16. Nuclear, Chemical and Biological Warfare (NCBW)
17. Judging distance. Description of ground and indication of landmarks.
18. Recognition and description of target. Observation and concealment. Field signals. Section formations.
19. Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
20. Types of communication, media, latest trends and developments.

Semester II: Physical Education and Yoga Practices

1. Teaching of skills of Hockey – demonstration practice of the skills and correction.
2. Teaching of skills of Hockey – demonstration practice of the skills and correction. And involvement of skills in games situation
3. Teaching of advance skills of Hockey – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
4. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.
5. Teaching of skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of the skills in games situation
6. Teaching of advance skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
7. Teaching of different track events – demonstration practice of the skills and correction.
8. Teaching of different track events – demonstration practice of the skills and correction.
9. Teaching of different track events – demonstration practice of the skills and correction with competition among them.
10. Teaching of different field events – demonstration practice of the skills and correction.
11. Teaching of different field events – demonstration practice of the skills and correction.
12. Teaching of different field events – demonstration practice of the skills and correction.
13. Teaching of different field events – demonstration practice of the skills and correction with competition among them.
14. Teaching of different asanas – demonstration practice and correction.
15. Teaching of different asanas – demonstration practice and correction.
16. Teaching of different asanas – demonstration practice and correction.

17. Teaching of different asanas – demonstration practice and correction.
18. Teaching of weight training – demonstration practice and correction.
19. Teaching of circuit training – demonstration practice and correction.
20. Teaching of calisthenics – demonstration practice and correction.

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

B. Sc.(Hons.) Agriculture, Part-II

III Semester

AGRON-211	Crop Production Technology – I (*Kharif* crops)	3(2+1)

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops. Cereals – rice, maize, sorghum, pearl millet and finger millet, pulses-pigeonpea, mungbean and urdbean; oilseeds- groundnut, and soybean; fibre crops- cotton & Jute; forage crops-sorghum, cowpea, cluster bean and napier.

Practical

Rice nursery preparation, transplanting of Rice, sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of *kharif* season crops, effect of sowing depth on germination of *kharif* crops, identification of weeds in *kharif* season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of *kharif* season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of *kharif* season crops, visit to research centres of related crops.

Lecture schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Pearl millet-importance, origin, distribution ,production, soil and climatic requirement (grain & forage).	1
2.	Pearl millet- improved varieties,(grain and forage) seed and sowing, intercultural operation/weed management, mid-season corrections, intercropping and fertilizer management (grain & forage).	1
3.	Pearl millet-water management, plant protection measures, harvesting, yield and cutting management in forage	1
4.	Maize- importance, origin, distribution, production , soil and climatic requirement, improved varieties, seed and sowing	1
5.	Maize- intercultural operations/weed management, fertilizer and water management, plant protection measures, harvesting and yield	1
6.	Sorghum- importance, origin, distribution, production, soil and climatic requirement and improved varieties for grain and forage	1
7.	Sorghum- seed and sowing, intercultural operations/weed management, fertilizer, and water management for grain and forage	1
8.	Sorghum- plant protection measures, harvesting, yield and cutting management in forage	1

9.	Rice- importance, origin, distribution, production, soil and climatic requirement.	1
10.	Rice-improved varieties, nursery raising, seed and sowing, intercultural operations/ weed management, fertilizer and water management	1
11.	Rice-plant protection measures, harvesting, processing and yield	1
12.	Groundnut – importance of oilseeds and groundnut, origin, distribution, production, soil and climatic requirements	1
13.	Groundnut-growth habits , improved varieties, seed and sowing, pegging	1
14.	Groundnut –intercultural operations/ weed management , fertilizer, and water management, plant protection measures, harvesting shelling and yield	1
15.	Soybean – importance, origin, distribution, production, soil and climatic requirement, improved varieties, seed and sowing	1
16.	Soybean- fertilizer, water and weed management, plant protection measures, harvesting and yield	1
17.	Pigeon pea- importance of pulses and pigeon pea , origin, distribution, soil and climatic requirement, improved varieties	1
18.	Pigeon pea- seed and sowing, intercultural operations/weed management fertilizer and water management, plant protection measures, harvesting and yield	1
19.	Cotton- importance, origin, distribution, production, soil and climatic requirements, types of cotton, improved varieties	1
20.	Cotton- seed and sowing, intercultural operations; weed management, fertilizer, and water management	1
21.	Cotton- plant protection measures, harvesting, quality and yield	1
22.	Clusterbean – package of practices	1
23.	Sesame- package of practices	1
24.	Castor – package of practices	1
25.	Mothbean- package of Practices	1
26.	Urdbean -package of practices	1
27.	Mungbean package of practices	1
28.	Cowpea – package of practices	1
29.	Napier - package of practices	1
30.	Minor millets - package of practices	1
31.	Sunhemp – package of practices	1
32.	Acquaintance about *Panicum , Lasiuras and Cenchrus*	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Identification of seeds, crops and other inputs of kharif season	1
2.	Sowing methods of different *kharif* crops	1

3.	Seed bed preparation of *kharif* crops including rice nursery and transplanting	1
4.	Working out seed rate, real value, seed size, depth and germination related numerical	1
5.	Seed treatment and preparation of seed material for sowing	1
6.	Preparation of seed material for planting of grasses	1
7.	Fertilizer application in crops, including top dressing and foliar feeding	1
8.	Identification of weeds in *kharif* season crops	1
9.	Morphological description of *kharif* season crops	1
10.	Irrigation operation in various crops	1
11.	Judging physiological maturity in standing crops	1
12.	Cotton seed treatment	1
13.	Effect of seed size on germination and seedling vigour	1
14.	Yield attributes and calculation on theoretical yield and harvest index	1
15.	Study of crop varieties and important agronomic and forage experiments at farm	1
16.	Visit of experiments at farm/research centres of related crops	1

Reference Books

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Singh, S.S.and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
4. Singh, S.S.and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
6. Prasad, Rajendra. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
7. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi
8. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Publishers, Ludhiana.
9. आर्य, आ.एल. एवं आर्य, केशव- 2016. खरीफ सस्य उत्पादन, कल्यानी पब्लिशर्स, लुधियाना
10. शक्तावत, मोहन सिंह एवं व्यास, अभय कुमार- 2000. वैज्ञानिक फसल प्रबन्धन, यश पब्लिशिंग हाउस, बीकानेर

GPB-211	Fundamentals of Plant Breeding	3(2+1)

Theory

Historical development, concept, nature and role of plant breeding, objectives of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and pollination, apomixes, self – incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization, introduction; Centre of origin/diversity. Component 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, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; population improvement, Breeding methods in asexually propagated crops, clonal selection and hybridization; 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. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops.

Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregating populations. Methods of calculating mean, range, variance, standard deviation, heritability.

Designs used in plant breeding experiment, analysis of Randomized Block Design and components of genetic variance. To work out the mode of pollination in a given crop and extent of natural out crossing. Prediction of performance of double cross hybrids.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Plant breeding: concept, nature, objectives and role of plant breeding	1
2	Historical development of plant breeding	1
3	Major achievements and future prospects	1
4	Genetics in relation to plant breeding	1
5	Modes of reproduction and pollination, apomixes	1
6	Self – incompatibility	1
7	Male sterility- genetic consequences	1
8	Domestication, Acclimatization, introduction, Centre of origin/diversity	1
9	Component of Genetic variation; Heritability and genetic advance	1
10	Genetic basis of self- pollinated crops and pure line theory	1
11	Breeding methods in self- pollinated crops- mass and pure line selection	1
12	Hybridization techniques	1
13	Handling of segregating population (pedigree, bulk and back cross method)	1
14	Multiline concept	1
15	Concepts of population genetics and Hardy-Weinberg Law	1
16	Genetic basis and methods of breeding cross pollinated crops	1
17	Population improvement and modes of selection	1
18	Heterosis and inbreeding depression	1
19	Development of inbred lines and hybrids	1
20	Composite and synthetic varieties	1
21	Breeding methods in asexually propagated crops	1
22	Clonal selection and hybridization	1

23	Wide hybridization and pre-breeding	1
24	Polyploidy in relation to plant breeding	1
25	Mutation breeding- methods and uses	1
26	Breeding for important biotic and abiotic stresses	1
27	Breeding for important abiotic stresses	1
28	Biotechnological tools-DNA markers,	1
29	Marker assisted selection	1
30	Participatory plant breeding	1
31	Intellectual Property Rights and Patenting	1
32	Plant Breeders and & Farmer's Rights	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Plant Breeder's kit	1
2	Study of germplasm of various crops	1
3	Study of floral structure of self pollinated crops	1
4	Study of floral structure of cross pollinated crops	1
5	Emasculation and hybridization techniques in self pollinated crops I	1
6	Emasculation and hybridization techniques in self pollinated crops II	1
7	Emasculation and hybridization techniques in self & cross pollinated crops.	1
8	Emasculation and hybridization techniques in self & cross pollinated crops.	1
9	Consequences of inbreeding on genetic structure of resulting populations	1
10	Study of male sterility system	1
11	Handling of segregating populations	1
12	Methods of calculating mean, range, variance, standard deviation, heritability.	1
13	Designs used in plant breeding experiment	1
14	Analysis of Randomized Block Design and components of genetic variance	1
15	To work out the mode of pollination in a given crop and extent of natural out crossing	1
16	Prediction of performance of double cross hybrids	1

Reference Books

1. Alard, R.W. 2000.Principles of Plant Breeding. John Willey & Sons, New York.
2. Chahel, G.S. and S.S. Ghosal.2002.Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
3. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.
4. Singh, P. 2001.Essentials of Plant Breeding-Principles and Methods. Kalyani Publishing House, New Delhi.
5. Jain,H.K. and M.c. Kharsckwal.2004 Plant Breeding- Mendelian to Molecular approach. Narosa Publishing House, New Delhi.

AGECON-211	Agricultural Finance and Co-Operation	3(2+1)

Theory

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, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports

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 cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of NAFED.

Practical

Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture.	2
2	Agricultural credit: meaning, definition, need, classification.	2
3	Credit analysis: 4 R's, and 3C's of credits.	2
4	Sources of agricultural finance: institutional and non-institutional	2
5	Commercial banks, social control and nationalization of commercial banks, Micro financing including KCC	2
6	Lead bank scheme, RRBs, Scale of finance and unit cost.	2
7	An introduction to higher financing institutions – RBI, NABARD, ADB, IMF	2
8	World bank, Insurance and Credit Guarantee Corporation of India and Cost of credit	2
9	Preparation and analysis of financial statements – Balance Sheet and Income Statement.	2
10	Basic guidelines for preparation of project reports	2
11	Agricultural Cooperation – Meaning, brief history of cooperative development in India	2
12	Objectives and principles of cooperation, significance of cooperatives in Indian agriculture	2
13	Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives	3
14	Farmers' service cooperative societies, processing cooperatives, farming cooperatives	3
15	Cooperative warehousing and role of NAFED.	2

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Optimum allocation of limited amount of capital among different enterprise.	2
2	Analysis of progress and performance of cooperatives using published data.	1
3	Analysis of progress and performance of commercial banks and RRBs using published data.	2
4	Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures.	2
5	Estimation of credit requirement of farm business – A case study.	2
6	Preparation and analysis of balance sheet – A case study.	2
7	Preparation and analysis of income statement – A case study.	2
8	Appraisal of a loan proposal – A case study.	1
9	Techno-economic parameters for preparation of projects.	2

Reference Books

1. Reddy, S. and Raghu Ram, P. "Agricultural Finance and Managament" Oxford and IBH, New Delhi
2. Singh, J.P. (1990) "Agricultural Finance- Theory and Practice" Ashish Publishing House, New Delhi
3. Pandey, U.K. "An Introduction to Agricultural Finance" Kalyani Publishes, New Delhi
4. Pandey, Mukesh and Tewari, Deepali "Rural and Agriculture Marketing"
5. Mamoria, C.B. "Agricultural Problems of India"
6. Krishnaswami, O.R. "Fundamental of Cooperation"
7. Nelson, A.G. and Murray, W.G. 1988 "Agricultural Finance" IOWA State University Press, Amies, IOWA, USA
8. Johl, S.S. : Essentials of Farm Financial Management, Atlas Books and Periodicals (TTPP)

AGRINFO-211©	Agricultural Informatics	2(1+1)

Theory

Introduction to Computers, Anatomy of Computers, Memory Concepts, Units of Memory, Operating System, types of operating system, Applicationsof MS-Officefor creating, Editing and Formatting adocument, Data presentation, tabulation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, creating database, uses of DBM Sin Agriculture, Internet and World Wide Web(WWW),Concepts, components and creation ofweb, HTML, XML coding.

Computer Programming: GeneralConcepts,Introductionto programming languages, concepts and standard input/output operations, Variables and Constants, Operators and Expressions, Flow of control, Inbuilt and User defined functions, programming techniques for agriculture.

e-Agriculture: concepts, design and development, application of innovative ways to use information and communication technologies (IT) in Agriculture. ICT for Data Collection, IT application for computation of waterand nutrient requirement of crops etc., Computer-controlled devices (automated systems) for Agri-input management, Smart phone mobile appsin Agriculture for farm advises, market price, post-harvest management etc; Introduction of DSS and its role in agriculture, Introduction and role of expert system in agriculture.

Practical

Study of Computer Components and accessories. Introduction of different operating systems such as windows, Unix, Linux, Creating, Files &Folders, File Management. Use of MS-WORD and MS Powerpoint forcreating, editing and presenting a scientific Document, Handling of Tabular data, animation, video tools, arttool, graphics, template & designs. MS-EXCEL – Creating as preadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific

data, handling macros. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system.

Introduction to World Wide Web (WWW) and its components, Introduction to HTML,

Use of smart phones and their devices in agro-advisory and dissemination of market information.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Introduction to Computers, Anatomy of Computers	**1**
2	Memory Concepts, Units of Memory, Operating System, types of operating system	**1**
3	Applications of MS-Office for creating, Editing and Formatting a document, Data presentation	**1**
4	Tabulation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types	**1**
5	creating database, uses of DBMS in Agriculture, Internet and World Wide Web (WWW), Concepts, components and creation of web, HTML, XML coding.	**1**
6	Computer Programming: General Concepts, Introduction to programming languages	**1**
7	Concepts and standard input/output operations	**1**
8	Variables and Constants	**1**
9	Operators and Expressions, Flow of control	**1**
10	Inbuilt and User defined functions, programming techniques for agriculture.	**1**
11	e-Agriculture: concepts, design and development, application of innovative ways to use information and communication technologies (IT) in Agriculture.	**1**
12	ICT for Data Collection	**1**
13	ITapplication for computation of water and nutrient requirement of crops etc.,	**1**
14	Computer-controlled devices (automated systems) for Agri-input management	**1**
15	Smart phone mobile appsin Agriculture for farm advises, market price, post-harvest management etc	**1**
16	Introduction of DSS and its role in agriculture, Introduction and role of expert system in agriculture.	**1**

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Study of Computer Components and accessories	1
2.	Introduction of different operating systems such as windows, Unix, Linux, Creating, Files & Folders,	1
3.	File Management. Use of MS-WORD	1
4.	MS Powerpoint forcreating, editing and presenting as cientific Document	1
5.	Handling of Tabular data, animation, video tools, arttool, graphics, template & designs.	1
6.	MS-EXCEL –Creating as pread sheet, use of statistical tools	1

7.	Writing expressions, creating graphs, analysis of scientific data	1
8.	handling macros.	1
9.	MS-ACCESS: Creating Database,	1
10.	Preparing queries and reports, demonstration of Agri-information system.	1
11.	Introduction to World Wide Web (WWW) and its components, and	1
12.	Introduction to HTML	1
13.	Introduction to HTML	1
14.	Use of smart phones and other devices inagro-advisory	1
15.	Dissemination of market information.	1
16.	Dissemination of market information.	1

Reference Books

1. Internet: The Complete Reference 2 Sub Edition by Margaret Levine Young.
2. Office 2013 All-In-One For Dummies by Peter Weverka.
3. Computer Fundamentals (With CD) 6th Edition 6th Edition by PradeepSinha and PritiSinha.
4. Principles of Programming Languages by Er.Anil Panghal.
5. E-Agriculture and Rural Development by CharalamposPatrikakis, Blessing Maumbe.

AGENGG-211	Farm Machinery and Power	2(1+1)

Theory

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and numerical, Familiarization with different systems of I.C. engines: Air cleaning, cooling, 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, Estimation of field capacity and power requirements of implements Familiarization with Primary and Secondary Tillage implement, implement for intercultural operations, Familiarization with sowing and planting equipment, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practical

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Familiarization with different types of primary and secondary tillage implements: mould board plough, disc plough and disc harrow . Familiarization with seed metering mechanism and calibration of seed drill, Familiarization with different types of sprayers and dusters Familiarization with different inter-culture implement, Familiarization with harvesting and threshing equipments and machinery.

Lecture schedule -Theory

S. No.	Title of Topic	Cr. Hrs.
1	Sources of farm power and its status in India and Rajasthan.	1

2	I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines	1
3	Study of different components of I.C. engine, I.C. engine terminology and numerical.	2
4	Air supply and exhaust system- Pre cleaners, oil soaked element type and oil bath type air cleaners; Fuel supply system	1
5	Lubricating system- splash system and forced feed system; Cooling system- thermosiphon system and forced circulation system	1
6	Transmission system- clutch, gear box, differential, final drive, P.T.O. shaft and hydraulic control system	1
7	Tractor types, Estimation of operational cost of a tractor .	1
8	Familiarization with Primary and Secondary Tillage implement	2
9	Numerical on field capacity and power requirement of implements	2
10	Familiarization with implement with intercultural operations	1
11	Familiarization with sowing and planting equipment,	1
12	Familiarization with Plant Protection equipment	1
13	Familiarization with harvesting and threshing equipment	1

Practical Schedule

S.No.	Title of Practical Exercise	Cr. Hrs.
1.	Study of different components of I.C. engine.	1
2	To study air cleaning and cooling system of engine,	1
3	Study of transmission system.	1
4	Study of transmission system-clutch, gear box, differential, final drive and P.T.O.	1
5	Familiarization with brake, steering, hydraulic control system of engine,	1
6	Tractor driving	3
7	Daily and periodic maintenance of tractor	1
8	Study of power tiller and garden tractor	1
9	Study of primary and secondary tillage implements: mould board plough, disc plough	1
10	Study of secondary tillage implements- cultivators, harrows and hoes	1
11	Study of seed metering mechanism and calibration of seed drill and numericals	2
12	Study of different types of sprayers and dusters	1
13	Study of harvesting machinery - reaper and thresher	3

Reference Books

1. Principles of Agricultural Engineering. Vol. I. 2012. Michael, A.M. and T.P. Ojha. Jain Brothers, Jodhpur.
2. Farm Tractors, Maintenance and Repair.1989. Rai and Jain. Tata Mc Graw Hill Publ. New Delhi.
3. Elements of Farm Machinery.1989. Srivastava, A.C. Oxford IBH Publ. Company, New Delhi.
4. Elements of Agricultural Engineering, Vol. I & III. 1989. Singhal, O.P. Suraj Prakashan, Allahabad.
5. Element of Agricultural Engineering. 1990. Sahay, Jagdishwar. Agro. Book Agency, New Chitragupta Nagar, Patna.

HORT-211	Production Technology for Vegetables and Spices	2(1+1)

Theory

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, brief about origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (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; Root crops such as Carrot, Radish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables.

Practical

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

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Importance of vegetables & spices in human nutrition and national economy	1
2.	Classification of Vegetables	1
3.	Types of vegetable gardening with special reference to kitchen gardening	1
4.	Brief about origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices: Tomato,	1
5.	Brinjal, Chilli, Capsicum,	1
6.	Cucumber, Melons, Gourds, Pumpkin,	1
7.	French bean, Peas and Okra	1
8.	Cole crops such as Cabbage, Knol-khol, Cauliflower	1
9.	Bulb crops such as Onion and Garlic	1
10.	Root crops such as Carrot, Radish, Beet-root	1
11.	Tuber crops such as Potato and Sweet potato	1
12.	Leafy vegetables such as Amaranthus and Palak	1
13.	Perennial vegetables such as drumstick and pointed gourd	1
14.	Seed spices: Coriander, cumin, fenugreek & fennel	1
15.	Black pepper and Cardamom	1
16.	Turmeric & Ginger	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Identification of Vegetables & Spice crops and their seeds	1
2.	Nursery raising, Direct seed sowing and Transplanting	1
3.	Study of morphological characters of different vegetables & spices	1
	Solanaceous crops (Tomato, Brinjal, Capsicum)	
4.	Cucurbitaceous crops	1
5.	Bulb crops	1

6.	Beans, Pea and Okra	**1**
7.	Root crops	**1**
8.	Tuber crop (Potato and Sweet Potato)	**1**
9.	Leafy vegetables	**1**
10.	Seed spices	**1**
11.	Black pepper and Cardamom	**1**
12.	Ginger and Turmeric	**1**
13.	Fertilizers applications	**1**
14.	Harvesting & preparation for market	**1**
15.	Economics of vegetables and spices cultivation	**2**

Reference Books

S. No.	Title of Book	Author	Publisher
1	A Text book on production technology of vegetables (2009)	B.R.Choudhary	Kalyani Publishers
2	Vegetable crops in India (2008)	K S Yawalkar	Agri-Horticultural Pub. House. Nagpur
3	Vegetable Crop Production (2007)	K.V.Kamath	Oxford Book Company
4	Olericulture in India (2008)	M.K.Rana	Kalyani Publishers
5	Handbook of Vegetable Crops (2008)	M.S.Dhaliwal	Kalyani Publishers
6	Vegetables for the Tropical Regions (1994)	Nath Prem	ICAR New Delhi
7	Modern Technology in Vegetable Production (2011)	P.Hazra	New India Publishing Agency, New Delhi
8	Major Spices of India- Crop Management Postharvest Technology (1993)	Pruthi, J.S	ICAR
9	Minor Spices of India- Crop Management Postharvest Technology (2001)	Pruthi, J.S	ICAR
10	Text book of vegetable, tuber crops and Spices (2014)	S. Thamburaj	ICAR
11	Production technology of spices and plantation crops (2005)	Shanmugavelu, K.G. Kumar, N and Peter, K.V	Agrosis, Jodhpur
12	Modern Vegetable varieties and production (2007)	Singh, D.K.	IBN publishers, Technology International Book Distributing Co, Lucknow
13	Indian Vegetables (2008)	Singh, Umashankar	Anmol Publications. Pvt. Ltd. New Delhi
14	Vegetable Crops (2002)	T.K.Bose	Nayaprakash, Kolkata
15	Vegetable Crops (2007)	T.R.Gopal Krishnan	New India Publishing Agency. New Delhi
16	Winter Vegetables: Advances & Developments	D.N. Singh etal.	Satish Serial Pub. House

17	Breeding of Vegetable crops	Ramchandra R.K.	Jaya Publishing House
18	Practicals on Vegetable Production Technology	Sharma & Katoch	Jaya Publishing House
19	Diseases of Vegetable crops and their integrated management: A colour handbook	Mishra, R.	NIPA
20	Seeds Production: Vegetables & Root Crops	Boswell, V.R.	ISPG

ESDM-211	**Environmental Studies and Disaster Management (to be shared by Entomonology with Soil Science & Agril. Chemistry)**	**3(3+0)**

Theory

Environment: Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, a) Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Ecology: Definition and scope. Ecosystems: Definition, concept, structure and function, components, producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

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. Conservation of biodiversity.

Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.

Disaster Management: 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.

Disaster Management- Concept of disaster management, national disaster management framework; financial arrangements; Central, state, district and local administration; NGO, Armed forces in disaster response; Disaster response; Police and other organizations.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Environment: Definition, scope and importance.	1*
2	Natural Resources: Renewable and non-renewable resources	1*
3	Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forest and tribal people.	1*
4	Water resources: Use and over-utilization of surface and ground water, floods, drought.	1*
5	Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.	1*
6	Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.	1*
7	Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.	1*
8	Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.	2*
9	Ecology: Definition and scope. Ecosystems: Definition, concept, structure and function, components, producers, consumers and decomposers, Energy flow in the ecosystem.	3
10	Ecological succession, Food chains, food webs and ecological pyramids.	2
11	Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	3
12	Biodiversity and its conservation: Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India.	4
13	Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.	3
14	Threats to biodiversity. Conservation of biodiversity.	2
15	Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards.	3
16	Solid Waste Management: causes, effects and control measures of urban and industrial wastes.	2*
17	Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management.	2*
18	Environmental ethics: Issues and possible solutions.	2*
19	Wasteland reclamation. Consumerism and waste products.	2*
20	Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.	3

21	Natural Disasters- Meaning and nature, types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.	3*
22	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.	3*
23	Disaster Management- Concept of disaster management, national disaster management framework; financial arrangements; Central, state, district and local administration; NGO, Armed forces in disaster response; Disaster response; Police and other organizations.	2*

Reference Books

1. Bamanayha B.R., Verma, L.N. and Verma A (2005). Fundamentals of Environmental Sciences, Yash Publishing House, Bikaner.
2. Dhaliwal G.S., Sangha G.S. and Ralhan P.K. (2000) Fundamentals of Environmental Sciences,Kalyani Publishers, New Delhi.
3. Odum E.P. and Barrett G.W.(2007) Fundamentals of Ecology, Akash Press, New Delhi.
4. Agrawal, K.C.(1999) Environmental Biology, Agro Botanica, Bikaner
5. Kumar, H.D.(1997) Modern concepts of Ecology, Vikash Publishing House Pvt. Ltd. New Delhi.
6. Dhaliwal G.S., and D.S.Kley (2006) Principles of Agricultural Ecology. Himalyan Publishing house, Bombay
7. Brij Gopal, and N.Bhardwaj (2004) Elements of Ecology. Vikash Publishing House, Pvt. Ltd., New Delhi.
8. Kudesta, V.P.(1990). Pollution Everywhere, Pragatgi Prakashan, Meerut
9. Nemeron, R.L.1976. Industrial Water Pollution. Addison Wesley
10. Mishra, P.C.(2001). Soil pollution and Soil Organism, Ashish Publishing House, 8/81, Punjab Bagh, New Delhi-110026.
11. Pathak, H.and Kumar, S.,(2003). Soil and Green House Effect, CBS Publishers and Distributors, 4596/1-A, 11, Dayaganj, New Delhi – 10002.

STAT-211	Statistical Methods	2(1+1)

Theory

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Introduction to Test of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in 2□2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

Practical

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t- test. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for 2□2 contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Introduction to Statistics and its Applications in Agriculture,	2
2.	Graphical Representation of Data, Measures of Central Tendency & Dispersion,	2
3.	Definition of Probability, Addition and Multiplication Theorem (without proof).	2
4.	Simple Problems Based on Probability.	2
5.	Binomial & Poisson Distributions,	2
6.	Definition of Correlation, Scatter Diagram.	2
7.	Karl Pearson's Coefficient of Correlation. Linear Regression Equations.	2
8.	Introduction to Test of Significance,	2
9.	One sample & two sample test t for Means,	2
10.	Chi-Square Test of Independence of Attributes in 2□2 Contingency Table	2
11.	Introduction to Analysis of Variance,	2
12.	Analysis of One Way Classification.	2
13.	Introduction to Sampling Methods,	2
14.	Sampling versus Complete Enumeration,	2
15.	Simple Random Sampling with and without replacement,	2
16.	Use of Random Number Tables for selection of Simple Random Sample.	2

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Graphical Representation of Data.	1
2.	Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles,	1
3.	Deciles & Percentiles.	1
4.	Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles.	1
5.	Measures of Dispersion (Ungrouped Data). Measures of Dispersion (Grouped Data).	1
6.	Moments,	1
7.	Measures of Skewness & Kurtosis (Ungrouped Data).	1
8.	Moments, Measures of Skewness & Kurtosis (Grouped Data).	1
9.	Correlation & Regression Analysis.	1
10.	Application of One Sample t-test.	1
11.	Application of Two Sample Fisher's t- test.	1
12.	Chi-Square test of Goodness of Fit.	1
13.	Chi-Square test of Independence of Attributes for 2□2 contingency table.	1
14.	Analysis of Variance One Way Classification.	1
15.	Analysis of Variance Two Way Classification.	1
16.	Selection of random sample using Simple Random Sampling.	1

Reference Books

1. Chandel S.R.S. A ,Handbook of Agricultural Statistics,Kanpur
2. Rangaswamy,A, A textbook of Agricultural Statistics, New Delhi
3. Gupta,S.P. Statistical Methods, Sultan Chand & Sons, New Delhi
4. Agarwal B L, Basic Statistics, Wiley Eastern, New Delhi

ANISC-211	Livestock and Poultry Management	4(3+1)

Theory

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers.

Important Indian and exotic breeds of cattle, buffalo, sheep, goat and poultry. Improvement of farm animals and poultry.

Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.

Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

External body parts of cattle, buffalo, sheep, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Judging of cattle, buffalo and poultry. Culling of livestock and poultry. Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk production, milking methods. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. Debeaking, dusting and vaccination. Economics of cattle, buffalo, sheep, goat, swine and poultry production.

Lecture Schedule -Theory

S. No.	Title of Topic	Cr. Hrs.
1	Role of livestock in the national economy.	2
2	Reproduction in farm animals and poultry.	2
3	Housing principles, space requirements for different species of livestock.	3
4	Housing principles, space requirements for different species of poultry.	2
5	Management of calves and growing heifers.	2
6	Management of milch animals.	1
7	Management of sheep.	2
8	Management of goat.	2
9	Management of swine.	1
10	Incubation, hatching and brooding.	3
11	Management of growers and layers.	1
12	Important Indian and exotic breeds of cattle.	2
13	Important Indian and exotic breeds of buffalo	2
14	Important Indian and exotic breeds of sheep.	2
15	Important Indian and exotic breeds of goat.	2
16	Important Indian and exotic breeds of poultry.	2
17	Improvement of farm animals and poultry.	2

18	Improvement of poultry	**1**
19	Digestion in livestock and poultry.	**2**
20	Classification of feedstuffs.	**1**
21	Proximate principles of feed.	**1**
22	Nutrients and their functions.	**2**
23	Feed ingredients for ration for livestock and poultry.	**2**
24	Feed supplements and feed additives.	**1**
25	Feeding of livestock.	**3**
26	Feeding of poultry.	**2**

Practical Schedule

S.No.	Title of Practical Exercise	Cr. Hrs.
1	External body parts of cattle & buffalo sheep	1
2	External body parts of swine & poultry	1
3	Handling and restraining of livestock.	1
4	Identification methods of farm animals& poultry.	1
5	Visit to IDF and IPF to study breeds of livestock and poultry	1
6	Daily routine farm operations and farm records.	1
7	Judging of cattle , buffalo &poultry.	1
8	Culling of livestock and poultry.	1
9	Planning and layout of housing for different types of livestock.	1
10	Computation of rations for livestock.	1
11	Formulation of concentrate mixtures.	1
12	Clean milk production, milking methods.	1
13	Management of chicks, growers and layers.	1
14	Debeaking, dusting and vaccination.	1
15	Economics of cattle, buffalo, sheep, goat, swine and poultry production.	2

Reference Books

1. Banerjee, G.C. 2013. A Text Book of Animal Husbandry. 8th Ed.ICAR.
2. Choudhary J.L. and Gupta Lokesh. 2016. A Text Book of Animal Husbandry. Somani Publication
3. Devendra C and Mecleroy GB 1982. Goat and Sheep Production in Tropics.
4. Dimri, U. Sharma, M C and Tiwari R.2013. Swine Production and Health Management. New India Pub Agency.
5. Sastry N S R and Thomas, Ck 2006. Livestock Production and Management. Kalyani
6. Singh, R A. 1996. Poultry Production. 3rd Ed Kalyani.
7. Thomas CK and Sastry, NSR.1991. Dairy Bovine Production. Kalyani.

Course Title: National Service Scheme III

Vocational skill development

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

Issues related environment

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

Disaster management

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

Entrepreneurship development

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

Formulation of production oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

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

B. Sc.(Hons.) Agriculture, Part-II
IV Semester

AGRON-221	Crop Production Technology – II (*Rabi* crops)	2(1+1)

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops- berseem, lucerne and oat.

Practical

Sowing methods of wheat and sugarcane, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of rabi crops at experimental farms. Study of rabi forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

Lecture Schedule -Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Wheat- importance, origin, distribution, production, soil and climatic requirement	1
2.	Wheat- improved varieties, seed and sowing, intercultural operations/ weed management	1
3.	Wheat- water and fertilizer management and importance of CRI stage.	1
4.	Wheat- plant protection , harvesting and yield and acquaintance about triticale	1
5.	Barley- Importance , origin, distribution, production, soil and climatic requirement and improved varieties	1
6.	Barley- seed and sowing, intercultural operations/ weed management, fertilizer and water management, plant protection measures, harvesting and yield .	1

7.	Rapeseed and mustard – importance , origin, distribution, production, classification , soil and climatic requirement .	1
8.	Rapeseed and mustard – improved varieties, seed and sowing, intercultural operations/ weed management and fertilizer management	1
9.	Rapeseed and mustard – water management, plant protection measures, harvesting and yield	1
10.	Chickpea- importance, origin, distribution, production, soil and climatic requirement and improved varieties.	1
11.	Chickpea –seed and sowing, intercultural operations/ weed management, fertilizer and water management, plant protection measures, harvesting and yield.	1
12.	Sugarcane- importance, origin, distribution, production, soil and climatic requirement.	1
13.	Sugarcane- improved varieties, seed and transplanting , intercultural operations/weed management and fertilizer management.	1
14.	Sugarcane- water management and plant protection measures.	1
15.	Sugarcane- maturity, harvesting and yield and factors affecting quality.	1
16.	Potato- importance, origin, distribution, production, soil and climatic requirement, improved varieties, seed and sowing .	1
17.	Potato- seed plot technique, intercultural operations/weed management, fertilizer and water management, plant protection measures , harvesting and yield .	1
18.	Lucerne – importance, soil and climatic requirement, improved varieties and seed and sowing	1
19.	Lucerne- weed, fertilizer and water management , cutting management and yield.	1
20.	Tobacco-.package of practices	1
21.	Sunflower- package of practices	1
22.	Linseed- package of practices	1
23.	Safflower – package of practices	1
24.	Taramira - package of practices	1
25.	Sugarbeet- package of practices	1
26.	Lentil- package of practices	1
27.	Pea and Frenchbean - package of practices	1
28.	Medicinal and aromatic crops-mentha, lemon grass and citronella	1
29.	Berseem - package of practices	1
30.	Isabgol - package of practices	1
31.	Oats - package of practices	1
32.	Opium poppy- package of practices	1

Practical Schedule

S.No.	Title of Practical Exercise	Cr. Hrs.
1.	Identification of seeds, crops and other inputs of *rabi* season	1
2.	Identification of weeds in *rabi* season crops	1
3.	Seed rate and related numerical	1
4.	Sowing of wheat and planting of sugarcane.	1

5.	Application of herbicides and related numericals.	1
6.	Judging physiological maturity of various crops	1
7.	Fertilizer application in crops and related numerical	1
8.	Morphological difference in wheat, barley and oat, rapeseed and mustard, berseem and lucerne.	1
9.	Judging sugarcane maturity based on brix ratio and related calculation	1
10.	Yield attributing characters, Theoretical yield and related numerical	1
11.	Crop harvesting and related numericals on harvest index.	1
12.	Working out seed index (test weight) and cost of cultivation.	1
13.	Oil extraction of medicinal crops	1
14.	Study of *rabi* forage experiments	1
15.	Study of important agronomic experiments of *rabi* crops at experimental farms	1
16.	Visit to research stations of related crops	1

Reference Books

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir.2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Singh, S.S.1998. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
3. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
4. Singh, S.S.and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.
6. Prasad, Rajendra. 2002. Text Book of Field Crops Production, ICAR, New Delhi.
7. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
8. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Books, New Delhi.
9. आर्य, आ.एल. एवं आर्य, केशव- 2016- रबी सस्य उत्पादन, कल्यानी पब्लिशर्स, लुधियाना
10. शक्तावत, मोहन सिंह एवं व्यास, अभय कुमार- 2000. वैज्ञानिक फसल प्रबन्धन, यश पब्लिशिंग हाउस, बीकान

HORT-221	Production Technology for Ornamental Crops, MAP and Landscaping	2(1+1)

Theory

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. 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.

Practical

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.

Lecture Schedule – Theory

S.No.	Title of Topic	Cr. Hrs.
1.	Importance and scope of ornamental crops, medicinal and aromatic plants	**1**
2.	Importance and scope landscaping and Principles of landscaping	**1**
3.	Landscape uses of trees, shrubs and climbers	**1**
4.	Production technology of important cut flowers like rose	**1**
5.	Gerbera and carnation under protected conditions	**2**
6.	Gladiolus, tuberose, chrysanthemum under open conditions	**2**
7.	Package of practices for loose flowers like marigold and jasmine under open conditions	**1**
8.	Production technology of important medicinal plants like ashwagandha, asparagus, safed musli	**1**
9.	Aloe, Cinnamon, periwinkle, isabgol	**1**
10.	Aromatic plants like mint, lemongrass	**1**
11.	Citronella, palmarosa	**1**
12.	Ocimum, rose	**1**
13.	Geranium, vetiver	**1**
14.	Processing and value addition in ornamental crops and MAPs produce	**1**

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Identification of Ornamental plants	**1**
2.	Identification of Medicinal and Aromatic Plants	**1**
3.	Nursery bed preparation and seed sowing	**1**
4.	Propagation of Ornamental and MAPs	**2**
5.	Training and pruning of Ornamental plants	**2**
6.	Planning and layout of garden. Bed preparation and planting of MAP	**2**
7.	Protected structures – care and maintenance	**1**
8.	Intercultural operations in flowers and MAP	**1**
9.	Harvesting and post harvest handling of cut and loose flowers. Processing of MAP	**3**
10.	Visit to commercial flower and MAP unit	**2**

Reference Books

S. No.	Title of Book	Author	Publisher
1	Fundamentals of ornamental horticulture and landscape gardening (2012)	A.K. Tiwari and R. Kumar	New India
2	Introductory Ornamental Horticulture (2006)	Arora, J.S.	Kalyani Publishers
3	Cultivation and Utilization of Medicinal and Aromatic plants (1982)	Atal, E.K. and Kapur, B.	CSIR, New Delhi

4	Cultivation of medicinal and aromatic plants (2001)	Azhar Ali Farooqui and Sreeramu, B.S.	United Press Limited
5	Flowering Garden trees (2014)	Bimaldas Chowdhury and Balai Lal Jana	Pointer publishers, Jaipur
6	Floriculture and Landscaping (2004)	Bose, T.K. Malti, R.G. Dhua, R.S. & Das, P.	Nayaprakash
7	Gardening in India (2004)	Bose, T.K. and Mukherjee, D.	Oxford & IBH Publishers
8	Ornamental Horticulture in India (1986)	Chadha, K.L. and Chaudhary, B.	ICAR
9	Landscape designing and ornamental plants (2014)	H.S.Grewal and Parminder Singh	
10	Ornamental plants (2009)	K.V.Peter.	New India publishing agency
11	Fundamentals of Garden designing (2013)	R.K. Roy	New India publishing agency
12	Fundamentals of Garden designing (2014)	Rajesh Srivastava	Agrotech press, Jaipur
13	Floriculture in India (2004)	Randhawa, G.S. Amitabha Mukhopadhyay	Allied Publishers Pvt. Ltd., New Delhi
14	Fundamentals of Ornamental Horticulture and Landscaping Gardening	Tiwari, A.K.	NIPA
15	Agrotechniques and Uses of Medicinal Plants	Gupta, R.D.	Astral
16	Complete Encyclopedia of House Plants: A comprehensive cross reference guide to popular house plant	Vermeulin, N.	Rebo

AGENGG-221	**Renewable Energy and Green Technology**	**2(1+1)**

Theory

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for bio-fuel production and their application, Familiarization with different types of biogas plants and gasifiers, bio-alcohol, biodiesel. Familiarization with briquetting techniques, Introduction of solar energy, solar collectors and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study briquetting machine, Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar dryers. To study solar distillation system.

Lecture Schedule-Theory

S. No	Title of Topic	Cr. Hrs.
1	Classification of energy sources, contribution of these of sources in agricultural sector.	1
2	Familiarization with biomass utilization for biofuel production and their application	2
3	Familiarization with different types of biogas plants.	2

4	Biogas production techniques and various uses of biogases.	2
5	Biomass gasification and familiarization with different gasifiers	2
6	Concept of briquetting and familiarization with briquetting machines	1
7	Introduction of solar energy, solar collectors and their application	2
8	Solar thermal applications in different gadgets	2
9	Solar photovoltaic techniques and applications.	1
10	Introduction of wind energy and their application	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Study of fixed dom and floating drum type biogas plants	2
2	Study of cross draft, updraft and down draft gasifiers	2
3	To study briquetting machine	1
4	Study of box type solar cooker	1
5	Study of solar water heating system	1
6	Study of solar distillation system	1
7	Study of solar dryer	2
8	Study of solar animal concentrate cooker	1
9	Study of solar photovoltaic water pumping system and visit to nearby solar photovoltaic water pumping system	2
10	Study of solar photovoltaic sprayer	1
11	Study of wind mill	1
12	Study of improved cook stove	1

Reference Books

1. G.D. Rai. Non-Conventional Energy Sources, Kh Publishers, New Delhi.
2. N. S. Rathore. A.K. Kurchania, N.L. Panwar. (2007). Non Conventional Energy Sources, Himanshu Publications.
3. N.S. Rathore. A. K. Kurchania, N.L. Panwar. (2007). Renewable Energy, Theory and Practice, Himanshu Publications.
4. K.C. Khandelwal. & S.S. Mandi. (1990). Biogas Technology.

SSAC-221	Problematic soils and their Management	2(1+1)

Theory

Quality and health of cultivated soils. Distribution of problem soils in different agro ecosystem of India. Their categorization based on properties. Reclamation and management of problem soils, Acid soils and highly and low permeable soils.

Bio-remediation of problem soils through multipurpose trees (MPTs).Land capability classification, land suitability classification.

Irrigation water – quality and standards. Utilization of poor quality water in agriculture.

Practical

*Visual diagnosis of problem soils

- Determination of cations (Na+, K+, Ca++ and Mg++) in ground water and soil samples
- Determination of anions (Cl-, SO4--, CO3-- and HCO3-) in ground waters and soil samples

- Determination of CaCO3 in calcareous soils
- Lime requirements of acid soil and gypsum requirements of sodic soil.
- Computation of SAR and RSC of irrigation water

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Soil quality- indicators and major factors affecting the soil quality, soil health	2
2	Distribution of problem soils in different agro-ecosystem of India.	1
3	Categorization of problem soils based on properties	1
4	Reclamation and management of salt affected soils	3
5	Reclamation and management of acid soils	1
6	High and low permeable soils and their management	1
7	Bio remediation of soils through multipurpose trees (MPTs),	1
8	Land capability classification	1
9	Land suitability classification.	1
10	Irrigation water – quality, classification and standards	3
11	Utilization of poor quality water in agriculture	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Visual diagnosis of problem soils	**2**
2	Determination of Ca^{++} and Mg^{++} in soil	**1**
3	Determination of Ca^{++} and Mg^{++} in ground water	**1**
4	Determination of Potassium in ground water and Soil	**1**
5	Determination of sodium in ground water and Soil	**1**
6	Determination of $CaCO_3$ in calcareous soil	**1**
7	Determination of $CO3^{--}$ and $HCO3^{-}$ in ground waters	**1**
8	Determination of $CO3^{--}$ and $HCO3^{-}$ in soil	**1**
9	Determination of chloride in ground waters and in soil	**2**
10	Determination of sulphate ($SO4^{--}$) in ground waters	**1**
11	Determination of sulphate ($SO4^{--}$) in soil	**1**
12	Determination of gypsum requirement of sodic soil	**1**
13	Determination of lime requirement of acid soil	**1**
14	Computation of SAR and RSC of irrigation water	**1**

Reference Books

1. Bear FE. 1964. Chemistry of the Soil. Oxford & IBH.
2. Jurinak JJ. 1978. Salt-affected Soils. Department of Soil Science & Biometeorology. Utah State Univ.
3. USDA Handbook No. 60. 1954. Diagnosis and improvement of Saline and Alkali Soils. Oxford & IBH.
4. Abrol, I.P. and Dhurva narayana, V.V. (1998) Technologies for wasteland development, ICAR, New Delhi-110012

5. Cirsan Paul, J.(1985) Principles of remote sensing. Longman, New York.
6. Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.
7. Somani, L.L. and Totawat, K.L. (1993). Management of salt affected soils and waters. Agrotech publishing Academy, Udaipur.
8. Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali soils of India, ICAR, New Delhi.
9. ISSS (2015) Fundamentals of Soil Science, Div. of Soil Science, IARI, New Delhi

HORT-222	Production Technology for Fruit and Plantation Crops	2(1+1)

Theory

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, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond and; minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops-coconut, arecanut, cashew, tea, coffee & rubber.

Practical

Seed propagation. Scarification and stratification of seeds. 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.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks	**1**
2.	Production technologies for the cultivation of major fruits - Mango	**1**
3.	Banana	**1**
4.	Citrus	**1**
5.	Grape	**1**
6.	Guava and Litchi	**1**
7.	Papaya and Sapota	**1**
8.	Apple	**1**
9.	Pear and Peach	**1**
10.	Walnut and Almond	**1**
11.	Minor fruits- Date palm, Ber, Aonla, Custard apple, Bael and Strawberry	**2**
12.	Pineapple and Pomegranate	**1**
13.	Plantation crops-Coconut and Cashew nut	**1**
14.	Areca nut & Rubber	**1**
15.	Tea and Coffee	**1**

Practical Schedule

S.No.	Title of Practical Exercise	Cr. Hrs.
1	Description and identification of fruit	**1**
2	Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops	**3**
3	Layout and planting of fruits and plantation crops	**2**
4	Preparation of plant bio regulators and their uses	**1**
5	Important pests of fruits and plantation crops	**1**
6	Important diseases of fruits and plantation crops	**1**

7	Important physiological disorders of fruits and plantation crops	**2**
8	Fertilizer application in fruits and plantation crops	**1**
9	Irrigation methods in fruits and plantation crops	**1**
10	Training and pruning of fruits and plantation crops	**1**
11	Weed management in fruits and plantation crops	**1**
12	Visit to commercial orchards	**1**

Reference Books

S. No.	Title of Book	Author	Publisher
1	Fruit Growing (2010)	Bal, J.S.	Kalyani Publishers
2	Advances in Temperate Fruit Production (2010)	Banday F.A. and Sharma M.K.	Kalyani Publishers
3	Tropical and Sub-Tropical-Vol-I (2002)	Bose, T.K., Mitra, S.K. and Sanyal, D.	Nayaprakash, Kolkata
4	Text Book of Temperate Fruits (2001)	Chadha, T.R	ICAR Publication
5	A text book on Pomology-IV Devoted to Temperate fruits (2009)	Chattopadhyay T.K.	Kalyani Publishers
6	Cultivation of Minor Fruits	Das B.C and Das S.N .	Kalyani Publishers
7	Advanced in Horticulture (2009)	K.L.Chadda	Malhotra Publishing House, New Delhi
8	Introduction to spices, Plantation crops and Aromatic plants (1997)	Kumar, N.J.B. M. Md. Abdul Khaddar, Ranga Swamy, P. and Irrulappan, I.	Oxford & IBH, New Delhi
9	Fruit crops (2007)	Radha T and Mathew L.	New India Publishing Agency
10	Commercial fruits (2004)	S.P. Singh	Kalyani Publishers
11	Fruit Production in India (2013)	W S Dhillon	Narendra Publishing House
12	Tropical & Sub-tropical Fruit Crops: Crop Improvement and varietal Wealth- 2 parts	S.N. Ghosh	Jaya Publishing House
13	Temperate Fruit Breeding	Ghosh, Verma Thakur	Jaya Publishing House
14	Breeding of underutilized Fruit crops	S.N. Ghosh	Jaya Publishing House
15	Breeding of Fruit Crops	Ramchandra etal	Jaya Publishing House
16	Fruit Breeding	Dinesh, M.R.	NIPA
17	Upto Date Fruit Science	Bikash Ghosh, Sayan Sau	Jaya Publishing House
18	Fruit tree Physiology	Dhillon/Bhatt	Jaya Publishing House
19	Disease management of Fruit crops	Rathore, G.S.	ATPA

GPB-221	Principles of Seed Technology	3(1+2)

Theory

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed.

Foundation and certified seed production of important cereals (Wheat, Rice, Maize, Sorghum and Bajra), pulses (Urd, Mung, Cowpea, Pigeonpea, Lentil, Gram, Field pea), oilseeds (Soybean, Rapeseed and Mustard, Groundnut, sesame), fodder (Berseem) and vegetables (Potato, cauliflower, tomato and chilli), Seed spices (Cumin, Coriander, Fennel and Fenugreek).

Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983.

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.

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. Measures for pest and disease control during storage.

Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing.

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum and Bajra. Seed production in major pulses: Urd, Mung, Cowpea, Pigeonpea, Lentil, Gram, Fieldpea. Seed production in major oilseeds: Soybean, Rapeseed and Mustard, Groundnut. Seed production in vegetable crops & Seed spices.

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.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Seed and seed technology: introduction, definition and importance.	1
2	Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production	1
3	Seed quality; Definition, Characters of good quality seed, different classes of seed.	1
4	Foundation and certified seed production of important cereals & fodder	1
5	Foundation and certified seed production of important pulses	1
6	Foundation and certified seed production of important oilseeds	1
7	Foundation and certified seed production of important vegetables	1
8	Foundation and certified seed production of important seed spices	1
9	Seed certification, phases of certification, procedure for seed certification, field inspection.	1
10	Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983.	1

11	Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test.	1
12	Detection of genetically modified crops, Transgene contamination in non-GM crops	1
13	GM crops and organic seed production.	1
14	Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing.	1
15	Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage.	1
16	Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Seed production in wheat including seed standards	1
2	Seed production in rice including seed standards	1
3	Seed production in Maize including seed standards	1
4	Seed production in Sorghum including seed standards	1
5	Seed production in Bajra including seed standards	1
6	Seed production in Urd, mung and cowpea including seed standards	1
7	Seed production in Pigeonpea including seed standards	1
8	Seed production in Lentil including seed standards	1
9	Seed production in Gram including seed standards	1
10	Seed production in Field pea including seed standards	1
11	Seed production in Soybean including seed standards	1
12	Seed production in Rapeseed and Mustard including seed standards	1
13	Seed production in Groundnut and sesame including seed standards	1
14	Seed production in vegetable (Potato, cauliflower, tomato and chilli) crops including seed standards	1
15	Seed production in Seed spices (fenugreek, fennel, cumin & coriander) including seed standards	1
16	Seed sampling methods	1
17	Physical purity test	1
18	Germination test	
19	Viability test	1
20	Seed and seedling vigour test	1
21	Genetic purity test: Grow out test	1
22	Electrophoresis	1
23	Seed certification: Procedure	1
24	Field inspection and Preparation of field inspection report	2
25	Visit to seed production farms	3
26	Visit to seed testing laboratories	2
27	Visit to seed processing plant	2

Reference Books

1. Agarwal, R.L.1991.Seed Technology, Oxford & IBH Publishing Co. Delhi
2. Agarwal, P.K. 1999. Seed Technology, ICAR, New Delhi.
3. Subir Sen and Nabinanda Ghosh.1999. Seed Science and Technology, Kalyani Publishers. New Delhi.
4. Dhirenra Khare and Mohan S. Bhale.2000. Seed Technology. Scientific Publishers (India), Jodhpur.
5. Maloo,S.R., Intodia, S.K. and Pratap Singh.2008. Beej Pradyogiki.Agrotech Publishing Academy.
6. A.K. Joshi and B.D. Singh.2005.Seed Technology. Kalyani Publishers, New Delhi.
7. Arya, P.S. 2001. Vegetable Breeding and Seed Production. Kalyani Pub., Ludhiana
8. Saxena,R.P.1984. Beez Sansadhan, GBPA&T, Pantnagar.
9. Singh, B.D. 2005. Plant Breeding. Kalyani Publishing House, New Delhi.

AGRON-222	Farming System & Sustainable Agriculture	1(1+0)

Theory

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its 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, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Farming System-scope, importance, and concept	1
2.	Types and systems of farming system and factors affecting types of farming	1
3.	Farming system components and their maintenance,	1
4.	Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation	1
5.	Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system	2
6.	Sustainable agriculture-problems and its impact on agriculture	1
7.	indicators of sustainability, adaptation and mitigation,	1
	conservation agriculture strategies in agriculture	1
8.	LEIA (Low external input agriculture),LEISA	1
9.	HEIA (High external input agriculture)	1
10.	Integrated farming system-historical background, objectives and characteristics,	1
11.	components of IFS and its advantages,	1
12.	Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques,	1
13.	Resource cycling and flow of energy in different farming system,	1
14.	farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.	1

Reference Books

1. Panda, S.C.2004. Cropping Systems and Farming Systems, Agrobios (India), Jodhpur.
2. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Sharma, Arun K. 2002. A Handbook of Organic Farming, Agrobios (India) Ltd., Jodhpur
4. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
5. Shukla, Rajeev K. 2004. Sustainable Agriculture, Surbhee Publications, Jaipur
6. Palaniappan, S.P.1985. Cropping Systems in the Tropics: Principles and Management, Wiley Easter Ltd. and TNAU, Coimbatore.
7. Reddy S. R. 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.
8. गौतम, आर.सी. एवं सिंह, पंजाब.1997. टिकाउ खेती, भारतीय कृषि अनुसन्धान परिषद, नई दिल्ली.

AGECON-221	Agricultural Marketing, Trade & Prices	3(2+1)

Theory

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; product life cycle (PLC) Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC. Market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark);Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing. Introduction to CWC, SWC, FCI, CACP & DMI. Cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & 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. GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

Practical

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

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure	1
2	Marketing mix and Market segmentation	1
3	Classification and characteristics of agricultural markets demand, supply	2
4	Producer's surplus, meaning, types, marketable and marketed surplus	1
5	Producer's surplus of agri-commodities, nature and determinants of demand and supply of farm products	1
6	Factors affecting marketable surplus of agri-commodities	1
7	Product life cycle, meaning and stages, characteristics of Product life cycle, strategies in different stages	1
8	Market promotion – advertising, personal selling, sales promotion	2
9	Publicity – their meaning, merits & demerits	1
10	marketing process and functions: exchange functions, buying and selling	1
11	Physical functions – storage, transport and processing	2
12	Facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK)	2
13	Market functionaries and marketing channels: Types and importance of agencies	1
14	Agencies involved in agricultural marketing, meaning and definition of marketing channel, channels for different farm products	1
15	Integration, efficiency, costs and margins & price spread	2
16	Factors affecting cost of marketing, reasons for higher marketing costs of farm commodities, How to reduce it	2
17	Role of Govt. in agricultural marketing. Introduction to CWC, SWC, FCI, CACP & DMI.	2
18	Cooperative marketing in India, Risk in marketing, Types of risk in marketing	2
19	speculation & hedging and futures trading	2
20	Agricultural prices and policy: Meaning, functions of price, administered prices	1
21	Need for agricultural prices and policy, Trade, Concept of International Trade and its theories	1
22	GATT and WTO, Agreement on Agriculture (AoA) and its implications on Indian agriculture, IPR.	2

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Calculation of elasticities: Plotting the demand and supply curves	3
2	Estimate correlation between prices and arrivals of crop	2
3	Workout the marketable and marketed surplus	2
4	Findout trend in time series on prices by different methods	2

5	Construct of index numbers for different crops	2
6	Study various marketing functions of local market	1
7	Identify the marketing channels	1
8	Workout marketing costs, margins and price spread	1
9	Assignment work for the students (Collection of data) regarding marketing of agri-commodities and presentation of report in the class: another work: NAFED, SWC, CWC, cooperative marketing society	2

Reference Books

1. Acharya SS & Aggarwal NL. (2011) Agricultural Marketing in India, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi
2. J.R. Moore, S.S. Johl and A.M. Khusro (1973) Indian Food Grain Marketing, Printice Hall, New Delhi
3. A.S. Kahlon & D.S. Tyagi (1983) Agricultural Price Policyin India, Allied Publishers, New Delhi
4. V.K. Bhall and S. Shiva Ramu (1996) International Business-Environment and Management, Anmol Publications (P) Limited, New Delhi
5. Chandra P. (1984) Projects: Preparation, Appraisal & Implementation, McGraw Hill Inc.
6. Sampat Mukherjee (2002) Modern Economic Theory. New Age International
7. Gupta RD & Lekhi RK. (1982) Elementary Economic Theory, Kalyani Publishers
8. S.S.Acharya & N.L.Agarwal,: Agricultural prices-Analysis and Policy, Oxford &IBH Publishing Co. PVT. LTD. New Delhi

ENTO-221	Insect Ecology and Principles of Integrated Pest Management (New Course)	2(1+1)

Theory

Part-I

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors–temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance. Agroecosystem.

Part-II

Categories of insect pests. IPM: Introduction, history, importance, concept, principles and limitations of IPM. Economic decision levels. Survey, surveillance and forecasting of insect pests. Assessment of insect pest population. Tools/ methods of IPM: Cultural, mechanical, physical, legislative, host plant resistance, biological, and chemical control. Importance, hazards and limitations of chemical control. Classification, toxicity and formulations of insecticides. Insecticides Act 1968-Important provisions. Symptoms of poisoning, first aid and antidotes. Recent methods of pest control- repellents, antifeedants, hormones and pheromones, attractants, gamma radiation and genetic control.

Practical

Sampling techniques for estimation of insect population and damage. Monitoring of insect population through light and pheromone traps. Insecticides and their formulations. Pesticide appliances and their maintenance. Calculations on the doses of insecticides and application techniques. Safe use of pesticides. Ientification of biocontrol agents. Mass production of NPV and fungi.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	**Insect Ecology:** Introduction, Environment and its components.	1
2	Effect of abiotic factors–temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents.	1
3	Effect of biotic factors – food competition, natural and environmental resistance. Agroecosystem.	1
4	**IPM:** Categories of pests. Introduction, history, importance, concept, principles and limitations of IPM.	1
5	Economic decision levels.	1
6	Survey, surveillance and forecasting of insect pests. Assessment of insect pest population.	1
7	Tools/ methods of IPM: Cultural, mechanical, physical, legislative, host plant resistance, biological.	3
8	Chemical control: Importance, hazards and limitations. Classification, toxicity and formulations of insecticides.	3
9	Insecticides Act 1968-Important provisions.	1
10	Application techniques of insecticides, symptoms of poisoning, first aid and antidotes.	1
11	Recent methods of pest control- repellents, antifeedants, hormones and pheromones, attractants, gamma radiation and genetic control.	2

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Sampling techniques for estimation of insect population and damage.	2
2	Monitoring of insect population through light and pheromone traps	1
3	Insecticides and their formulations.	2
4	Pesticide appliances: Handling and their maintenance of small kitchen garden sprayer, hand compression sprayer, knapsack sprayer, foot sprayer, power sprayer, hand rotary duster, power duster	4
5	Calculations on the doses of insecticides	1
6	Application techniques of insecticides.	1
7	Safe use of pesticides	1
8	Ientification of biocontrol agents	1
9	Mass production of NPV and fungi	3

Reference Books

1. Yazdani G.S. and Agarwal M.L. 1979. Elements of Insect Ecology. Naroji publishing house.
2. Atwal, A.S. and Dhaliwal, G.S. 2002. Agricultural Pests of South Asia and Their Management, Kalyani Publishers, New Delhi.

3. David, B.V. and Ramamurthy, V.V. 2016. Elements of Economic Entomology, 8th Ed. Popular Book Depot, Chennai.
4. Dhaliwal, G.S. and Ramesh Arora 2001. Integrated Pest Management. Concepts and Approaches. Kalyani publishers, New Delhi.
5. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
6. Metcalf, R.L and Luckman W.H. 1982. Introduction to Insect Pest Management. Wiley Inter Science publishing, New York.
7. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I, Kalyani Publishers, New Delhi.
8. Dhawan, A.K. Integrated Pest Management, Scientic Publishers, Jodhpur.

ENTO-222	Biopesticides and Biofertilizers (Elective course)	3(2+1)

Theory

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides and biorationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and techniques of biopesticides. Impediments and limitations in production and use of biopesticide.

Biofertilizers: 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 biofertilizers: AM mycorrhiza and ectomycorhiza. Nitrogen fixation: free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, 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

Isolation and purification of important biopesticides: Trichoderma Pseudomonas, Bacillus, Metarhyzium etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides.

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

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	History and concept of biopesticides.	1
2	Importance, scope and potential of biopesticide.	1
3	Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides and biorationales.	2
4	Botanicals and their uses.	1
5	Mass production technology of bio-pesticides.	4
6	Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.	2
7	Methods of application of biopesticides.	1
8	Methods of quality control and techniques of biopesticides.	2

9	Impediments and limitations in production and use of biopesticide.	1
10	Biofertilizers: introduction, status and scope.	1
11	Structure and characteristic features of bacterial biofertilizers: *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*;	2
12	Structure and characteristic features of cynobacterial biofertilizers- *Anabaena*, *Nostoc*,	1
13	Structure and characteristic features of Hapalosiphon and fungal biofertilizers: AM mycorrhiza and ectomycorhiza.	2
14	Nitrogen fixation: Free living and symbiotic nitrogen fixation.	2
15	Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.	2
16	Production technology: strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers.	3
17	FCO specifications and quality control of biofertilizers.	1
18	Application technology for seeds, seedlings, tubers, sets etc.	1
19	Biofertilizers: storage, shelf life, quality control and marketing.	1
20	Factors influencing the efficacy of biofertilizers.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	To study about mass production technology of important biopesticides: NPV, *Metarhyzium, Beauveria, Bt.* etc.	2
2	Identification of important botanicals. Preparation of plant extract: neem, karanj etc.	2
3	Visit to biopesticide laboratory in nearby area.	1
4	Field visit to explore naturally infected cadavers.	1
5	Identification of entomopathogenic entities in field condition.	1
6	Quality control of biopesticides.	1
7	Isolation and purification of important biopesticides: *Trichoderma Pseudomonas, Bacillus* and its production.	3
8	Isolation and purification of *Azospirillum, Azotobacter, Rhizobium* and P-solubilizers.	2
9	Mass multiplication and inoculum production of biofertilizers.	1
10	Isolation of AM fungi: wet sieving method and sucrose gradient method.	1
11	Mass production of AM inoculants.	1

Reference Books

1. Dhaliwal, GS & Koul O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
2. Srivastava, K.P. 2004. A Text Book of Entomology, Vol. I, Kalyani Publishers, New Delhi.
3. Biswas, T.D. and Mukherjee, S.K. 1990. Text Book of Soil Sciences, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Mukherjee, N. and Ghosh T. 1998. Agricultural Microbiology, Kalyani Publishers, New Delhi.
5. Pelczar, Jr. Michel J. Chan, E.C.S. and Krieg, Noel R. 1997. Microbiology. Tata McGraw -Hill Edition, 1993. India.
6. Rangaswami, G. and Bagyaraj, D.J. 1993. Agricultural Microbiology. Prentice Hall of India Pvt. Limited, New Delhi.
7. Vishunavat, K. and Kolte, S.J. 2005. Essentials of Phytopathological Techniques. Kalyani Publishers, New Delhi

8. Cook RJ & Baker KF. 1983. The Nature and Practice of Biological Control of Plant Pathogens. APS, St Paul, Minnesota.
9. Campbell R. 1989. Biological Control of Microbial Plant Pathogens. Cambridge Univ. Press, Cambridge.
10. Mukerji KG, Tewari JP, Arora DK & Saxena G. 1992. Recent Developments in Biocontrol of Plant Diseases. Aditya Books, New Delhi.

Course Title:National Service Scheme IV

Youth and crime

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

Civil/self defence

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

Resource mobilisation

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

Additional life skills

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

B. Sc.(Hons.) Agriculture, Part-III
V Semester

PPATH-311	Epidemiology and Integrated Disease Management	2(1+1)

Theory

Epidemiology and factors affecting disease development. Diagnosis of plant diseases. Disease triangle and tetrahedron. Forecasting of plant diseases.

Principles of plant disease management. Methods of integrated disease management: Host plant resistance, cultural, physical, legislative, biological and chemical control. IDM modules for wheat, rice, sugarcane, cotton, groundnut, mustard, potato, cumin, citrus and chickpea. Integrated nematode management in protected cultivation. Nature, chemical combination, general classification of fungicides and antibiotics. Safety issues in fungicidal uses. Pest risk analysis.

Practical

Diagnosis of plant diseases. Methods of plant disease measurement. Assessment of crop yield losses. Identification of bio-control agents. Mass multiplication of Trichoderma, Pseudomonas and Bacillus. Methods of pesticide application and their safe use. Study of structural details of sprayers, dusters and seed dressers. Awareness campaign at farmer's fields.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Epidemiology and factors affecting disease development	1
2	Diagnosis of plant diseases	1
3	Disease triangle and tetrahedron	1
4	Forecasting of plant diseases	1
5	Principles of plant disease management	1

6	Methods of integrated disease management: Host plant resistance, cultural, physical, legislative, biological and chemical control	4
7	IDM modules for wheat, rice, sugarcane, cotton, groundnut, mustard, potato, cumin, citrus and chickpea	2
8	Integrated nematode management in protected cultivation	1
9	Nature, chemical combination, general classification of fungicides and antibiotics	3
10	Safety issues in fungicidal uses. Pest risk analysis	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Diagnosis of plant diseases.	2
2	Methods of plant disease measurement.	2
3	Assessment of crop yield losses.	1
4	Identification of bio-control agents.	3
5	Mass multiplication of *Trichoderma, Pseudomona*s and *Bacillus*.	3
6	Methods of pesticide application and their safe use.	2
7	Study of structural details of sprayers, dusters and seed dressers.	2
8	Awareness campaign at farmer's fields.	1

Reference Books

1. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
2. Mehrotra, R.S. and Agrawal, A. 2013. Plant Pathology. 2nd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Singh, R.S. 2011. Introduction to Principles of Plant Pathology. 4th ed. Oxford & IBH Publishing Company. New Delhi.
4. Nene Y.L. and Thapliyal, P.N. 2011. Fungicides in Plant Diseases Control. 3rd Ed. Oxford & IBH published Co. Pvt. Ltd. New Delhi.
5. Dube, H.C. 2012, Modern Plant Pathology, 2nd ed. Agrobios (India), Jodhpur

SSAC-311	Manures, fertilizers and Soil Fertility Management	3(2+1)

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Soil organic matter , composition, properties and influences of soil fertility, Humic substances – nature and properties.

Chemical fertilizers: classification, specification and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

History of soil fertility and plant nutrition. criteria of essentiality. Forms of nutrients in soil, role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), Integrated nutrient management.

Practical

Introduction of analytical instruments and their principles, Estimation of soil organic carbon, Estimation of available N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils . Estimation of soil extractable S in soils.. Estimation of DTPA extractable Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

Lecture Schedule - Theory

S. No	Title of Topic	Cr. Hrs.
1.	Introduction and importance of organic manures	1
2.	Classification of organic manures	1
3.	Properties and methods of preparation of bulky manures.	2
4.	Properties and methods of preparation of concentrated manures.	2
5.	Green/leaf manuring.	1
6.	Soil organic matter , composition, properties and influences of on soil fertility,	2
7.	Humic substances – nature and properties.	1
8.	Chemical fertilizers: classification,	1
9.	Major Nitrogenous fertilizers (Urea, Ammonium sulphate, CAN) - Chemistry of manufacturing and fate in soil	2
10.	Major Phosphatic fertilizers(SSP, TSP and DAP)- Chemistry of manufacturing and fate in soil	2
11.	Major Potassic fertilizers (MOP and Potassium sulphate) - Chemistry of manufacturing and fate in soil	1
12.	Secondary & micronutrient fertilizers sources and application	1
13.	Complex fertilizers, nano fertilizers sources and application	1
14.	Soil amendments, Fertilizer Storage, Fertilizer Control Order.	2
15.	History of soil fertility and plant nutrition	1
16.	Criteria of essentiality. Forms of nutrients in soil,	1
17.	role, deficiency and toxicity symptoms of essential plant nutrients,	2
18.	Mechanisms of nutrient transport to plants	1
19.	Factors affecting nutrient availability to plants	1
20.	Soil fertility evaluation	2
21.	Soil testing. Critical levels of different nutrients in soil.	1
22.	Indicator plants. Methods of fertilizer recommendations to crops.	1
23.	Factor influencing nutrient use efficiency (NUE),	1
24.	Integrated nutrient management.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Introduction of analytical instruments and their principles	2
2.	Determination of organic carbon in soil	1
3.	Determination of available nitrogen in soil	1
4.	Determinationof soil extractable phosporus	2
5.	Determination of exchangeable potassium in soil	1

6.	Determination of soil extractable sulphur in soil	2
7.	Determination of available DTPA extractable -zinc in soil	1
8.	Determination of Ca+Mg in soil	1
9.	Rapid plant tissue test- N, P and K	2
10.	Estimation of N,P, K and S in plant	3

Reference Books

1. Biswas, T.D. and Mukherjee, S.K. (2006) Text book of soil science.Tata McGraw Hill publishing Co. Ltd, New Delhi
2. Das, D.K. (2002) Introductory Soil Science, Kalyani publisher, New Delhi
3. Rai, M.M. (2002) Principal of Soil Science, Mac Millan India Ltd, New Delhi
4. Mehra R.K. (2004) Text book of Soil Science, ICAR New Delhi
5. ISSS (2002) Fundamental of Soil Science Div. of Soil Science, IARI, New Delhi
6. Jackson, M.L. (1973) Soil chemical analysis, Prentice Hall of India, Pvt. Ltd New Delhi
7. Piper, C.S. (1950) Soil and Plant analysis, .Hans publications, Bombay
8. Singh Dhyan, Chhonkar,P.K. and Dwivedi V.S. (2005) Manul on Soil Plant and water analysis. Westville Publishing House, New Delhi
9. Tisdale,S.L. Nelson, W.L. Beaton, J.D. and Havlin, J.L.(1991) Soil fertility and fertilizers (5th ed.).Prentice Hall of India, Pvt .Ltd, New Delhi.
10. Singh Vinay (1996) (Hindi) Soil Science, fertilizer & Manures , V.K. Prakashan Barot Merrut (U.P)
11. Yawalkar, K.S. and Agarwal. J.P. (1992). Manure and fertilizers. Agriculture- Horticulture Publishing House, Nagpur.
12. Sanchalli, V.K. (1960). Chemistry and Technology of Fertilizers. Reinhebl publishing corporation, New York,USA.
13. Chopra, S.L. and Kanwar, J.S. (1991). Analytical Agriculture, Chemistry, Kalyani Publishers, New Delhi.
14. Tandon, H.L.S. (1989). Soil water and fertilizers analysis, Fertilizer Development and Consultant organization, New Delhi
15. FAI. (1999). Fertilizer (Control) Order, 1985 and the essential commodities Act, 1995. FAI, New Delhi, pp. 203.
16. Kanwar, J.S. (1976). Soil Fertility: theory and practice. (ed) ICAR, New Delhi pp. 583.
17. McVicker, M.H. (1952). Using commercial fertilizers, Interstate Danvilk, US

ENTO-311	**Pests of Crops and Stored Grains and Their Management**	**4(3+1)**

Theory

Scientific name, order, family, distribution, identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests.

Polyphagous insect pests: Locust, grasshopper, whitegrub, termite and red hairy caterpillar.

Pests of field crops: Cereals and millets- Rice: Brown plant hopper, yellow stem borer, rice hispa. Sorghum: Shootfly; Maize: Stem borer; Sugarcane: Pyrilla, whitefly, shoot borer. Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar. Oilseeds: Mustard aphid, sawfly, painted bug, groundnut aphid, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer. Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug, mealy bug.

Pests of vegetables Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer (Covered in gram); Okra- Shoot and fruit borer (Covered in cotton). Potato: Tuber moth. Chilli: Thrips; Onion and garlic: Thrips. Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar (Covered in tobacco). Pea: Stem fly. Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite.

Pests of fruit crops Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly. Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar. Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar. Pomegranate: Anar butterfly; Ber: Fruit fly. Coconut: Black headed caterpillar; Apple: San Jose scale, woolly aphid.

Pests of ornamental crops: Rose aphid, hollyhock tinged bug, jasmine budworm.

Pests of spices and condiments: Aphid, seed midge.

Pests of stored grains: Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth, grain mite, storage fungi. Storage structures and methods of grain storage. Principles of stored grain pest management.

Rodents and their management in fields and godowns.

Birds of agricultural importance and their management.

Practical

Study of identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests of various field crops, vegetable crops, fruit crops, ornamental crops, spices and condiments including polyphagous insect pests. Identification of insect pests and mtes associated with stored grains. Determination of insect infestation by different methods. Fumigation of grain stores and godowns. Identification of rodents and birds and their control operations. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to nearest FCI godowns.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	**Polyphagous insect pests:** Locust, grasshopper, whitegrub, termite and red hairy caterpillar	5
2	Rice: Brown plant hopper, yellow stem borer, rice hispa. Wheat:: mite.	2
3	Sorghum: Shootfly; Maize: Stem borer.	2
4	Sugarcane: Pyrilla, whitefly, shoot borer.	1
5	Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar	2
6	Oilseeds: Mustard aphid, sawfly, painted bug, groundnut aphid, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer.	4
7	Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug, mealy bug.	3
8	**Pests of vegetables crops:** Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer (Covered in gram); Okra- Shoot and fruit borer (Covered in cotton). Potato: Tuber moth. Pea: Stem fly.	2
9	Chilli: Thrips; Onion and garlic: Thrips; Drum stick green caterpillar.	1
10	Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar (Covered in tobacco).	3
11	Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite.	2
12	**Pests of fruit crops:** Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly.	3
13	Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar.	2
14	Pomegranate: Anar butterfly; Ber: Fruit fly, mite.	1
15	Coconut: Black headed caterpillar; Apple: San Jose scale, woolly aphid.	2
16	**Ornamental Crops:** Rose aphid, hollyhock tinged bug, jasmine budworm.	1
17	**Spices and condiments:** Aphid, seed midge	1

18	**Pests of stored grains:** Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth, grain mite, storage fungi.	4
20	Rodents and their management in fields and godowns.	2
21	Birds of agricultural importance and their management.	1
22	Storage structures and methods of grain storage.	2
23	Principles of stored grain pest management.	2

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Study of identification, host range and nature of damage, biology and bionomics, and management of important arthropod pests of various field crops: Polyphagous pests- Locust, grasshopper, whitegrub, termite and red hairy caterpillar	2
2	Field crops Rice: Brown plant hopper, yellow stem borer, rice hispa Sorghum: Shootfly; Maize: Stem borer; Sugarcane: Pyrilla, whitefly, shoot borer Pulses: Gram pod borer, cutworm. Tobacco: Tobacco caterpillar Oilseeds: Mustard aphid, sawfly, painted bug, groundnut aphid, soybean girdle beetle, castor semilooper, castor capsule borer, sesame leaf and capsule borer. Cotton: Jassid, whitefly, spotted and pink bollworm, red cotton bug, mealy bug.	4
3	**Vegetable crops:** Identification, host range and nature of damage, biology and bionomics, and management of important insect pests: Brinjal- brinjal shoot and fruit borer; Tomato- Fruit borer; Okra- Shoot and fruit borer; Potato: Tuber moth; Chilli: Thrips; Onion and garlic: Thrips; Cruciferous vegetables: Cabbage caterpillar, diamondback moth, semilooper, tobacco caterpillar; Pea: Stem fly; Cucurbitaceous vegetables: Melon fruit fly, red pumpkin beetle, red vegetable mite.	3
4	**Pests of fruit crops:** Mango: Mango hopper, mealy bug, stem borer, fruit fly; Guava: Fruit fly; Citrus: Citrus psylla, citrus caterpillar, bark eating caterpillar; Pomegranate: Anar butterfly; Ber: Fruit fly.	2
5	**Pests of stored grains:** Khapra beetle, lesser grain borer, rice weevil, red rust flour beetle, pulse beetle, Angoumois grain moth.	1
6	Rodents and their management in fields and godowns.	1
7	Birds of agricultural importance and their management.	1
8	Storage structures and methods of grain storage.	1
9	Management of stored grain pests.	1

Reference Books

1. Atwal, A.S. and Dhaliwal, G.S. 2002. Agricultural Pests of South Asia and Their Management, Kalyani Publishers, New Delhi.
2. David, B.V. and Ramamurthy, V.V. 2016. Elements of Economic Entomology, 8th Ed. Popular Book Depot, Chennai.
3. Mathur and Upadhyay, 2005. A Text Book of Entomology, Aman Publishing House, Meerut.
4. Nayar, M.R.G.K. 1986. Insects and Mites of Crops in India, ICAR, New Delhi.
5. Srivastava, K.P. 2004. A Text Book of Entomology, Vol.I & II, Kalyani Publishers, New Delhi.
6. Reddy, P. Parvatha 2010. Insect, Mite and Vertebrate Pests and their Management in Horticultural Crops. Scientific Publishers, Jodhpur.

PPATH-321	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

FIELD CROPS: Wheat: Rusts, loose smut, karnal bunt, powdery mildew and ear cockle & tundu. Barley: Stripe, covered smut and molya disease. Sugarcane: Red rot, whip smut, grassy shoot, ratoon stunting and Pokkah boeng. Sunflower: Alternaria blight. Lentil: Wilt. Mustard: Alternaria blight, white rust and Sclerotinia rot. Gram: Root rot, wilt and Ascochyta blight. Isabgol: Downy mildew. Coriander: Stem gall. Cumin: Wilt, powdery mildew and Alternaria blight. Fenugreek: Powdery mildew.

HORTICULTURAL CROPS: Mango: Malformation and black tip. Citrus: Canker, dieback and gummosis. Grape vine: Downy mildew and anthracnose. Apple: Scab. Ber: Powdery mildew. Aonla: Rust. Potato: Late blight, black heart, golden nematode and leaf roll. Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot. Onion: Purple blotch. Chillies: Anthracnose and leaf curl. Pea: Root rot and powdery mildew. Carrot: Alternaria blight. Rose: Dieback and powdery mildew. Marigold: Blight.

Practical:

Identification and histopathological studies of following selected diseases of field and horticultural. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

Wheat: Rusts, loose smut, karnal bunt and ear cockle. Barley: Stripe, covered smut and molya disease. Sugarcane: Red rot, whip smut and grassy shoot. Sunflower: Alternaria blight. Lentil: Wilt. Mustard: Alternaria blight, white rust and Sclerotinia stem Rot. Gram: Root rot, wilt and Ascochyta blight. Isabgol: Downy mildew. Coriander: Stem gall. Cumin: Wilt, powdery mildew and Alternaria blight. Fenugreek: Powdery mildew.

Mango: Malformation and black tip. Citrus: Canker, dieback and gummosis. Grape vine: Downy mildew and anthracnose. Ber: Powdery mildew. Aonla: Rust. Potato: Late blight, black heart, golden nematode and leaf roll. Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot. Onion: Purple blotch. Chillies: Anthracnose and leaf curl. Pea: Root rot and powdery mildew. Carrot: Alternaria blight. Rose: Dieback and powdery mildew. Marigold: Blight.

Note: Students should submit 30 pressed and well-mounted specimens.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	**Wheat**: Rusts, loose smut, karnal bunt, powdery mildew and ear cockle & tundu.	4
2	**Barley:** Stripe, covered smut and molya disease.	2
3	**Sugarcane:** Red rot, whip smut, grassy shoot, ratoon stunting and Pokkah boeng.	3
4	**Mustard:** Alternaria blight, white rust and Sclerotinia rot. **Sunflower**: Alternaria blight.	2
5	**Gram:** Root rot, wilt and Ascochyta blight. **Lentil:** Wilt.	2
6	**Coriander:** Stem gall. **Fenugreek:** Powdery mildew. **Cumin**: Wilt, powdery mildew and Alternaria blight.	3
	Mango: Malformation and black tip.	2
7	**Citrus:** Canker, dieback and gummosis.	1
8	**Grape vine:** Downy mildew and anthracnose. **Isabgol:** Downy mildew.	1
9	**Apple:** Scab. **Aonla:** Rust.	1
10	**Potato:** Late blight, black heart, golden nematode and leaf roll.	3

11	**Cucurbits:** Powdery mildew, mosaic, Choanephora rot and root knot.	2
12	**Onion**: Purple blotch. **Carrot:** Alternaria blight.	1
13	**Chillies:** Anthracnose and leaf curl.	1
14	**Pea:** Root rot and powdery mildew. **Ber:** Powdery mildew.	2
15	**Rose:** Dieback and powdery mildew.	1
16	**Marigold:** Blight.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Identification and histopathological studies of following selected diseases of field and horticultural crops:	-
2	**Wheat**: Rusts, loose smut, karnal bunt and ear cockle.	1
3	**Barley:** Stripe, covered smut and molya disease.	1
4	**Sugarcane:** Red rot, whip smut and grassy shoot.	1
5	**Mustard:** Alternaria blight, white rust and Sclerotinia stem rot.	1
6	**Gram:** Root rot, wilt and Ascochyta blight. **Lentil:** Wilt.	1
7	**Coriander:** Stem gall. **Cumin**: Wilt, powdery mildew and Alternaria blight. **Fenugreek:** Powdery mildew. **Ber:** Powdery mildew.	1
8	**Mango**: Malformation and black tip. **Aonla:** Rust.	1
9	**Citrus:** Canker, dieback and gummosis.	1
10	**Grape vine:** Downy mildew and anthracnose. **Isabgol:** Downy mildew.	1
12	**Potato:** Late blight, black heart, golden nematode and leaf roll.	1
13	**Cucurbits:** Powdery mildew, mosaic, Choanephora rot and root knot.	1
14	**Chillies:** Anthracnose and leaf curl. **Pea:** Root rot and powdery mildew. **Rose:** Dieback and powdery mildew. **Marigold:** Blight.	1
15	**Sunflower**: Alternaria blight. **Onion**: Purple blotch. **Carrot:** Alternaria blight.	1
16	Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.	2
17	**Note:** Students should submit 30 pressed and well-mounted specimens.	-

Reference Books

1. Cook, A A. 1981. Diseases of Tropical and Sub-Tropical Field Fiber and Oil Plants. Mac Millan Publishing Co. New York.
2. Gupta V K and Paul Y S. 2002. Diseases of Field Crops. Indus Publishing Co. New Delhi.
3. Mehrotra R S and Agrawal A. 2013. Plant Pathology. 2nd.ed. Tata McGraw-Hill Publishing Co Ltd. New Delhi.
4. Rangaswamy, G and Mahadevan, A. 2001. Diseases of Crop Plants in India. Prentice hall of India Pvt. Ltd. New Delhi.
5. Singh, R.S. 2009. Plant Diseases. 9th ed. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.
6. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
7. Gupta, S.K. and Thind, T.S. 2012. Disease problem in vegetable production. Scientific Publishers, Jodhpur.
8. Singh, R.S. 2012. Diseases of Fruit Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
9. Singh, R.S.1998. Diseases of Vegetable Crops. 3rd ed. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

GPB-311	Crop Improvement-I (*Kharif* crops)	2(1+1)

Theory

Centers of origin, distribution of species, wild relatives in different cereals (Rice, Maize, Sorghum and Bajra); pulses (Urd, Mung, Cowpea and Pigeonpea); oilseeds (Soybean, sessame and Groundnut); fibres (Cotton); fodders (Bajra) and cash crops (Castor); vegetable and horticultural crops (Chilli and tomato); Plant genetic resources, its utilization and conservation Floral biology, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species; viz., Rice, Maize, Sorghum, Pearl Millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame , Castor, Cotton, Cowpea, Pearl millet and Tobacco. 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.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Crop improvement aspects in **Rice** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production.	1
2	Crop improvement aspects in **Maize** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production.	1
3	Crop improvement aspects in **Sorghum** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc& hybrid seed production.	1
4	Crop improvement aspects in **Bajra** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc& hybrid seed production.	1
5	Crop improvement aspects in **Urd, Mung and Cowpea** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
6	Crop improvement aspects in **Pigeonpea** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc& hybrid seed production.	1
7	Crop improvement aspects in **Soybean** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
8	Crop improvement aspects in **Sessame** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1

9	Crop improvement aspects in **Groundnut** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
10	Crop improvement aspects in **Cotton** and **castor** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
11	Crop improvement aspects in **Chilli** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
12	Crop improvement aspects in **tomato**as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
13	Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional	1
14	Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops	1
15	Ideotype concept	1
16	Climate resilient crop varieties for future.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Emasculation and hybridization techniques in Rice, Maize	1
2	Emasculation and hybridization techniques in Sorghum and Bajra	1
3	Emasculation and hybridization techniques in Urd, Mung, Cowpea, Pigeonpea	1
4	Emasculation and hybridization techniques in, Soybean, sessame	1
5	Emasculation and hybridization techniques in and Groundnut ans cotton	1
6	Maintenance breeding of different kharif crops.	1
7	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods.	1
8	Study of field techniques for seed production and hybrid seeds production in *Kharif* crops	1
9	Estimation of heterosis, inbreeding depression and heritability	1
10	Layout of field experiments	1
11	Study of quality characters	1
12	Donor parents for different characters	1
13	Visit to seed production plots	2
14	Visit to AICRP plots of different field crops.	2

Reference Books

1. Chopra, V.L. 2000 Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Rajendra Gupta. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Mandal, AK., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.
4. Manjit S. Kang 2004. Crop Improvement: Challenges in the Twenti-First Century (Edt). International Book Distributing Co. Lucknow.

5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co.. INC, East Port, Conneacticut, USA.
6. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
7. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
8. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

EDBC-311	Entrepreneurship Development and Business Communication	2 (1+1)

Theory

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agrienterprises, Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management and Total quality management, Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri-entrepreneurship and rural enterprise.

Practical

Assessing entrepreneurial traits, problem solving skills, managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring and supervision, identification and selection of business idea, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs;	1
2	SWOT Analysis & achievement motivation,	1
3	Government policy and programs and institutions for entrepreneurship development,	2
4	Impact of economic reforms on Agribusiness/ Agrienterprises,	1
5	Entrepreneurial Development Process;	1
6	Business Leadership Skills;	1
7	Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation),	2
8	Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills),	2
9	Problem solving skill, Supply chain management and Total quality management,	2
10	Project Planning, Formulation and report preparation;	2
11	Financing of enterprise, Opportunities for agri-entrepreneurship and rural enterprise.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Assessing entrepreneurial traits, problem solving skills, managerial skills and achievement motivation,	4
2	Exercise in creativity, time audit through planning, monitoring and supervision,	4

3	Identification and selection of business idea,	2
4	Preparation of business plan and proposal writing,	2
5	Visit to entrepreneurship development institute and entrepreneurs.	4

Reference Books

1. Harold Koontz & Heinz Weihrich. 2004. Essentials of Management: An International Perspective, 2nd Ed. Tata Mc-Graw Hill Publishing Pvt Ltd.
2. Chole, R. R. Kapse, P. S. and Deshmukh, P. R. 2012. Entrepreneurship Development and Communication Skills scientific Publisher (India), Jodhpur.
3. Bhaskaran, S. 2014. Entrepreneurship Development and Management. Aman Publishing House, Meerut.
4. Mancuso, J. 1974. The Entrepreneurs Handbook (Vol. 192(, Artech House, Inc., USA.
5. Karthikeyan,C. et al. 2008.. A Text Book of Agricultural Extension Management. Atlantic Publishers, New Delhi.
6. Natrajan,K. and Ganeshan, K.P. 2012.Principles of Management. Himalaya Publishing House, New Delhi.
7. Balasubrmanyam M. 1985. Business Communication. Vani Educational Books, New Delhi.
8. Dipak De & Basavaprabhu Jirli. Entrepreneurship : Theory and practice in agriculture. ISBN 81-85694-57-5, Ganga Kaveri Publishing House, D.35/77, Jangamawadimath, Varanasi-221001 (India), Ph.- 0542-2451936
9. Mukesh Pandey & Deepali Tewari. 2010. The Agribusiness Book. IBDC Publishers.
10. Nandan H. 2011. Fundamentals of Entrepreneurship. PHI Learning Pvt Ltd India.
11. Poornima Charantimath. 2006. Entrepreneurship Development: Small Business Enterprise. Pearson Education.
12. Harsh, S.B., Conner, U.J. and Schwab, G.D. 1981. Management of the Farm Business. Prentice Hall Inc., New Jersey.
13. Joseph, L. Massie. 1995. Essentials of Management. Prentice Hall of India Pvt. Ltd., New Delhi.
14. Omri Rawlins, N. 1980. Introduction to Agribusiness. Prentice Hall Inc., New Jersey
15. Thomas W Zimmer and Norman M Scarborough. 1996. Entrepreneurship. Prentice-Hall, New Jersey.
16. Mark J Dollinger. 1999. Entrepreneurship Strategies and Resources. Prentice-Hall, Upper Saddal Rover, New Jersey.
17. Khanka S S. 1999. Entrepreneurial Development. S. Chand and Co. New Delhi.
18. Mohanty S K. 2007. Fundamentals of Entrepreneurship. Prentice Hall India Ltd., New Delhi.

AGRON-311	Geoinformatics and Nanotechnology and Precision Farming	2(1+1)

Theory

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics-definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

Practical

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture;	2
2	Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture	1
3	Crop discrimination and Yield monitoring, soil mapping;	1
4	fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS;	2
5	Remote sensing concepts and application in agriculture;	1
6	Image processing and interpretation;	1
7	Global positioning system (GPS), components and its functions;	1
8	Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs;	1
9	STCR approach for precision agriculture;	1
10	Nanotechnology, definition, concepts and techniques,	1
11	brief introduction about nanoscale effects,	1
12	nano-particles, nano-pesticides, nano-fertilizers, nano-sensors,	1
13	Use of nanotechnology in seed and water for scaling-up farm productivity	1
14	Use of nanotechnology in fertilizer and plant protection for scaling-up farm productivity	1

Practical Schedule

S.No.	Title of Practical Exercise	Cr. Hrs.
1	Introduction to GIS software, spatial data creation and editing.	2
2	Introduction to image processing software. Visual and digital interpretation of remote sensing images.	2
3	Generation of spectral profiles of different objects.	2
4	Supervised and unsupervised classification and acreage estimation.	2
5	Multispectral remote sensing for soil mapping.	1
6	Creation of thematic layers of soil fertility based on GIS.	1
7	Creation of productivity and management zones	1
8	Fertilizers recommendations based of VRT and STCR techniques.	1
9	Crop stress (biotic/abiotic) monitoring using geospatial technology.	1
10	Use of GPS for agricultural survey.	1
11	Formulation, characterization and applications of nanoparticles in agriculture.	1
12	Projects formulation and execution related to precision farming	1

Reference Books

1. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press
2. Srivastava, G.S. 2014. An Introduction to Geoinformatics. McGrew Hill Education (India) Pvt. Ltd. , New Delhi
3. Gupta, R.K. and Subhash Chander. 2008. Principles of Geoinformatics. Jain Brothers, New Delhi.
4. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers & Distributors
5. Sekhon, B.S. 2014. Nanotechnology in agri-food production: an overview. Nanotechnology, Science and Applications 7:31-532.

AGRON-312	Practical Crop Production – I (*Kharif* crops)	1(0+1)

Practical

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

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Introduction of the course, crop planning and allotment of field	1
2.	Field preparation, application of manures and fertilizers	1
3.	Selection of crop and varieties, seed treatment and sowing	1
4.	Sowing of crops.	1
5.	Observation of germination	1
6.	Thinning and gap filling	1
7.	Intercultural operations-hoeing and weeding	1
8.	Intercultural operations-hoeing and weeding	1
9.	Water management- application of irrigation water and demonstrating methods of irrigation	1
10.	Top dressing of fertilizer (urea).	1
11.	Insect and pest management (control)- application of insecticides	1
12.	Disease management (control)- application of fungicides	1
13.	Harvesting	1
14.	Threshing, winnowing and storage	1
15.	Marketing of produce	1
16.	Preparation of balance sheet including estimating cost of cultivation and net return per student as well as per team of a group of student	1

Reference Books

1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of AgronomyAgrobios (India), Jodhpur.
3. Reddy, S. R., 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

GPB-312	Intellectual Property Rights	1(1+0)

Theory

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.

Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights,

Trademark, Industrial design, Geographical indications, 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 Cooperation Treaty, Patent search and patent database.

Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning 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 and its salient features, access and benefit sharing.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO.	1
2	Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc.	1
3	Types of Intellectual Property and legislations covering IPR in India	1
4	Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets.	1
5	Patents Act 1970	1
6	Patent system in India, patentability, process and product patent, filing of patent,	1
7	Patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing.	1
8	Patent Cooperation Treaty, Patent search and patent database.	1
9	Origin and history including a brief introduction to UPOV for protection of plant varieties.	1
10	Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights.	1
11	Registration of plant varieties under PPV&FR Act 2001	1
12	Breeders, researcher and farmers rights.	1
13	Traditional knowledge-meaning and rights of TK holders.	1
14	Convention on Biological Diversity	1
15	International treaty on plant genetic resources for food and agriculture (ITPGRFA).	1
16	Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.	1

Reference Books

1. Pandey, N. and Dharani, K. Intellectual Property Rights. PHI Learning Pvt. Ltd, New Delhi.
2. Venkatraman, M. 2014. An Introduction to IPR, Venkalp Books, Bangaluru.
3. Singh, K. K.. 2015. Biotechnology and Intellectual Property Rights. Springer.
4. Singh, B.D. 2009. Plant Breeding- Principles & Methods., Kalyani Publisher, New Delhi.

HORT-311	Landscaping (Elective course)	3(2+1)

Theory

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes. Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical

Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lath house. Use of computer software, visit to important gardens/ parks/ institutes.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Importance and scope of landscaping	**1**
2.	Principles of landscaping	**2**
3.	Garden styles and types	**3**
4.	Terrace gardening	**1**
5.	Vertical gardening	**1**
6.	Garden components	**1**
7.	Garden adornments	**1**
8.	Rockery	**1**
9.	Water garden	**1**
10.	Walk-paths, bridges, other constructed features etc. gardens for special purposes	**1**
11.	Trees: selection, propagation, planting schemes, canopy management	**1**
12.	Shrubs and herbaceous perennials: selection, propagation, planting schemes, rchitecture	**1**
13.	Climber and creepers: importance, selection, propagation, planting	**1**
14.	Annuals: selection, propagation, planting scheme	**1**
15.	Other garden plants: palms, ferns, grasses, cacti succulents and shade loving plants	**2**
16.	Pot plants: selection, arrangement, management	**1**
17.	Bio-aesthetic planning: definition, need, planning	**2**
18.	Landscaping of urban and rural areas	**1**

19.	Peri-urban landscaping (roof garden)	**1**
20.	Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions	**2**
21.	Bonsai: principles and management	**2**
22.	Lawn: establishment and maintenance	**2**
23.	CAD application	**2**

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Identification of trees, shrubs, annuals, pot plants	**2**
2.	Identification of tools and implements used in landscape design	**1**
3.	Propagation of trees, shrubs and annuals	**2**
4.	Care and maintenance of plants, **shrubs and trees**	**1**
5.	Potting and repotting	**1**
6.	Training and pruning of plants for special effects	**1**
7.	Lawn establishment and maintenance	**1**
8.	Layout of formal gardens	**1**
9.	Layout of informal gardens	**1**
10.	Layout of special type of gardens (sunken garden, terrace garden, rock garden)	**2**
11.	Designing of conservatory and lath house	**1**
12.	Use of computer software	**1**
13.	Visit to important gardens/ parks/ institutes	**1**

Reference Books

1. J.S. Arora. Introductory Ornamental Horticulture, Kalyani Publication, Ludhiana
2. Gopala swamiengar. The Complete Gardening in India, The Hosali Press, Bangalor
3. G.S. Randhwana & A. Mukha padhyay, Floriculture in India, Allied Publishers, New Delhi
4. Noel Kingsbursy, Planting Design- Gardens, Timer Press
5. A.K. Tiwari, Fundamental of Ornamental Horticulture & Landscaping , New India Publishing Agency

B. Sc.(Hons.) Agriculture, Part-III
VI Semester

AGRON-321	Rainfed Agriculture & Watershed Management	2(1+1)

Theory

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices,Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Rainfed agriculture- definition, history and its importance in India with particular to references Rajasthan	1
2.	Problems of dryland agriculture related to climate, soil, technological and socio economic conditions	1
3.	Soil and water conservation techniques,	1
4.	Drought: types,	1
5.	effect of water deficit on physio- morphological characteristics of the plants,	1
6.	Use of antitranspirants-their kind, mode of action and effect on crop yield.	1
7.	Crop adaptation and mitigation to drought;	1
8.	Water harvesting: importance, its techniques,	1
9.	Efficient utilization of water through soil and crop management practices,	1
10.	Water harvesting techniques in dry farming areas	1
11.	Watershed management- concept, definition, objectives and principles	1
12.	Integrated watershed management for drylands	1
13.	A study of model watershed area	1
14.	Management of crops in rainfed areas,	1
15.	Contingent crop planning for aberrant weather conditions,	1
16.	Alternate cropping and land use strategies for dryland agriculture	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Studies on climate classification,	1
2.	studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons.	1
3.	Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India.	1
4.	Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops.	1
5.	Critical analysis of rainfall and estimation of moisture index and aridity index and possible drought period in the country	1
6.	Field demonstration on construction of water harvesting structures	1
7.	effective rainfall and its calculation.	1

8.	Studies on cultural practices for mitigating moisture stress.	1
9.	Spray of antitranspirants on dryland crops and their effect on crops	1
10.	Characterization and delineation of model watershed	1
11.	Field demonstration on soil & moisture conservation measures	1
12.	Crops and cropping systems for drylands	1
13.	Acquiring skill in tillage methods for *in-situ* moisture c onservation	1
14.	Mulching and its effects on soil moistures conservation	1
15.	Seed soaking, seed treatment with chemicals for sowing in dryland areas	1
16.	Visit to rainfed research station/watershed.	1

Reference Books

1. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana.
2. Reddy, S.R. and Reddy, G. Prabhakara. 2015. Dryland Agriculture, Kalyani Publishers, Ludhiana.
3. Murthy, J. V. S. 1994. Watershed Management, Wiley Eastern Limited. New Age International Limited, New Delhi.
4. Dhruva Narayan, V.V. Singh, P.P., Bhardwaj, S.P., U. Sharma, Sikha, A.K., Vital, K.P.R. and Das, S.K. 1987. Watershed Management for Drought Mitigation, ICAR, New Delhi.
5. Singh, R.P., Sharma, S., Padmnabhan, N.V. , Das, S.K. and Mishra, P.K. 1990.A Field Manual on Watershed Management, ICAR (CRIDA), Hyderabad.
6. Singh, P.K. 2000. Watershed Management (Design & Practices), e-media Publication, Udaipur, India.
7. Singh, R.P. 1995, Sustainable Development of Dryland Agriculture in India. Scientific Publishers, Jodhpur.
8. Singh, S.S., 1993, Crop Management Under Irrigated and Rainfed Conditions, Kalyani Publishers, New Delhi.

AGENGG-321	Protected Cultivation and Secondary Agriculture	2(1+1)

Theory

Green house technology: Introduction, Types of Green Houses; climate control in Green house, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses naturally ventilated solar green house, high tech green house, use of green house in drying. Concept and construction of low tunnels. Use of shade net house in protected cultivation.

Important Engineering properties such as physical, thermal and aero & hydrodynamic of cereals, pulses and oilseed. Concepts of cleaning and grading. Drying and dehydration: Moisture measurement, EMC, drying theory, various drying methods, commercial grain dryers (bin dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer). Material handling equipment: conveyer and elevators, their principle, working and selection.

Practical

Study of different types of green houses based on shape. Measurement of solar radiation, CO2 level, humidity and temperature inside and outside green house. Determination of drying rate of agricultural products inside green house. Study of green house equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying method. Study of spiral, centrifugal and disc separator. Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant and agro processing plant.

Lecture Schedule-Theory

S. No	Title of Topic	Cr. Hrs.
1	Introduction to Green house technology, types of green houses and climate control inside green house.	1

2	Planning and design of greenhouses.	1
3	Design criteria of green house for cooling and heating purposes and green house equipments	1
4	Materials of construction for traditional and low cost green houses	1
5	Irrigation systems used in greenhouses	1
6	Naturally ventilated solar green house, high tech green house	1
7	Use of green house in drying	1
8	Concept and construction of low tunnels. Use of shade net house in protected cultivation	2
9	Important Engineering properties such as physical, thermal and aero & hydrodynamic of cereals, pulses and oilseed	1
10	Concepts of cleaning and grading vibratory and rotary type air cleaner	1
11	Drying and dehydration: Moisture measurement, EMC, drying theory, various drying methods.	1
12	Commercial grain dryers (bin dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer).	2
13	Material handling equipment: conveyers and elevators, their principle, working and selection.	2

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Study of various shapes of green houses.	1
2.	Measurement of climatic factors inside and outside green houses and study of green house equipments.	1
3.	Construct of low tunnel in vegetable crops.	2
4.	Study of Shade net house and visit to nearby shade net house	2
5.	Drying of agriculture produce in green house	1
6.	Determination of moisture content by oven drying methods.	1
7.	Study of spiral, centrifugal and disc separator.	1
8.	Determination of Moisture content of various grains by moisture meter.	2
9.	Study of mechanical grain dryer- bin dryer, tray dryer, and re-circulatory dryer	2
10.	Visit to seed processing plant	1
11.	Visit to agro processing plants	2

Reference Books

1. Green house: Science and Technology. 2016. Kothari S, S.C.Kaushic and A.N.Mathur. Himanshu Publication, Udaipur.
2. Green House Technology- Application and Practice. Sharma A and V.M.Salokhe. 2006. Agro Tech. publication, Udaipur
3. Principles of Agricultural Engineering, Vol. I. 2012. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.
4. Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.
5. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.
6. Unit operation of Agriculture Processing. 2004. Shay K.M. and Singh, K.K. Vikas Publication House, New Delhi.

PPATH-321	Diseases of Field and Horticultural Crops and their Management-II	3(2+1)

Theory

Symptoms, etiology, disease cycle and management of major diseases of following crops:

FIELD CROPS: Wheat: Rusts, loose smut, karnal bunt, powdery mildew and ear cockle & tundu. Barley: Stripe, covered smut and molya disease. Sugarcane: Red rot, whip smut, grassy shoot, ratoon stunting and Pokkah boeng. Sunflower: Alternaria blight. Lentil: Wilt. Mustard: Alternaria blight, white rust and Sclerotinia rot. Gram: Root rot, wilt and Ascochyta blight. Isabgol: Downy mildew. Coriander: Stem gall. Cumin: Wilt, powdery mildew and Alternaria blight. Fenugreek: Powdery mildew.

HORTICULTURAL CROPS: Mango: Malformation and black tip. Citrus: Canker, dieback and gummosis. Grape vine: Downy mildew and anthracnose. Apple: Scab. Ber: Powdery mildew. Aonla: Rust. Potato: Late blight, black heart, golden nematode and leaf roll. Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot. Onion: Purple blotch. Chillies: Anthracnose and leaf curl. Pea: Root rot and powdery mildew. Carrot: Alternaria blight. Rose: Dieback and powdery mildew. Marigold: Blight.

Practical

Identification and histopathological studies of following selected diseases of field and horticultural. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

Wheat: Rusts, loose smut, karnal bunt and ear cockle. Barley: Stripe, covered smut and molya disease. Sugarcane: Red rot, whip smut and grassy shoot. Sunflower: Alternaria blight. Lentil: Wilt. Mustard: Alternaria blight, white rust and Sclerotinia stem rot. Gram: Root rot, wilt and Ascochyta blight. Isabgol: Downy mildew. Coriander: Stem gall. Cumin: Wilt, powdery mildew and Alternaria blight. Fenugreek: Powdery mildew.

Mango: Malformation and black tip. Citrus: Canker, dieback and gummosis. Grape vine: Downy mildew and anthracnose. Ber: Powdery mildew. Aonla: Rust. Potato: Late blight, black heart, golden nematode and leaf roll. Cucurbits: Powdery mildew, mosaic, Choanephora rot and root knot. Onion: Purple blotch. Chillies: Anthracnose and leaf curl. Pea: Root rot and powdery mildew. Carrot: Alternaria blight. Rose: Dieback and powdery mildew. Marigold: Blight.

Note: Students should submit 30 pressed and well-mounted specimens.

Lecture Schedule- Theory

S. No.	Title of Topic	Cr. Hrs.
1	**Wheat**: Rusts, loose smut, karnal bunt, powdery mildew and ear cockle & tundu.	4
2	**Barley:** Stripe, covered smut and molya disease.	2
3	**Sugarcane:** Red rot, whip smut, grassy shoot, ratoon stunting and Pokkah boeng.	3
4	**Mustard:** Alternaria blight, white rust and Sclerotinia rot.	2
	Sunflower: Alternaria blight.	
5	**Gram:** Root rot, wilt and Ascochyta blight. **Lentil:** Wilt.	2
6	**Coriander:** Stem gall. **Fenugreek:** Powdery mildew.	3
	Cumin: Wilt, powdery mildew and Alternaria blight.	
	Mango: Malformation and black tip.	2
7	**Citrus:** Canker, dieback and gummosis.	1
8	**Grape vine:** Downy mildew and anthracnose. **Isabgol:** Downy mildew.	1
9	**Apple:** Scab. **Aonla:** Rust.	1
10	**Potato:** Late blight, black heart, golden nematode and leaf roll.	3

11	**Cucurbits:** Powdery mildew, mosaic, Choanephora rot and root knot.	2
12	**Onion**: Purple blotch. **Carrot:** Alternaria blight.	1
13	**Chillies:** Anthracnose and leaf curl.	1
14	**Pea:** Root rot and powdery mildew. **Ber:** Powdery mildew.	2
15	**Rose:** Dieback and powdery mildew.	1
16	**Marigold:** Blight.	1

Practical Schedule

S.No.	Title of Practical Exercise	Cr. Hrs.
1	Identification and histopathological studies of following selected diseases of field and horticultural crops:	-
2	**Wheat**: Rusts, loose smut, karnal bunt and ear cockle.	1
3	**Barley:** Stripe, covered smut and molya disease.	1
4	**Sugarcane:** Red rot, whip smut and grassy shoot.	1
5	**Mustard:** Alternaria blight, white rust and Sclerotinia stem rot.	1
6	**Gram:** Root rot, wilt and Ascochyta blight. **Lentil:** Wilt.	1
7	**Coriander:** Stem gall. **Cumin**: Wilt, powdery mildew and Alternaria blight. **Fenugreek:** Powdery mildew. **Ber:** Powdery mildew.	1
8	**Mango**: Malformation and black tip. **Aonla:** Rust.	1
9	**Citrus:** Canker, dieback and gummosis.	1
10	**Grape vine:** Downy mildew and anthracnose. **Isabgol:** Downy mildew.	1
12	**Potato:** Late blight, black heart, golden nematode and leaf roll.	1
13	**Cucurbits:** Powdery mildew, mosaic, Choanephora rot and root knot.	1
14	**Chillies:** Anthracnose and leaf curl. **Pea:** Root rot and powdery mildew. **Rose:** Dieback and powdery mildew. **Marigold:** Blight.	1
15	**Sunflower**: Alternaria blight. **Onion**: Purple blotch. **Carrot:** Alternaria blight.	1
16	Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.	2
17	**Note:** Students should submit 30 pressed and well-mounted specimens.	-

Reference Books

1. Cook, A A. 1981. Diseases of Tropical and Sub-Tropical Field Fiber and Oil Plants. Mac Millan Publishing Co. New York.
2. Gupta V K and Paul Y S. 2002. Diseases of Field Crops. Indus Publishing Co. New Delhi.
3. Mehrotra R S and Agrawal A. 2013. Plant Pathology. 2nd.ed. Tata McGraw-Hill Publishing Co Ltd. New Delhi.
4. Rangaswamy, G and Mahadevan, A. 2001. Diseases of Crop Plants in India. Prentice hall of India Pvt. Ltd. New Delhi.
5. Singh, R.S. 2009. Plant Diseases. 9th ed. Oxford & IBH Publishing Company Pvt. Ltd. New Delhi.
6. Agrios, G.N. 2005. Plant Pathology. 5th ed. Academic Press, New York.
7. Gupta, S.K. and Thind, T.S. 2012. Disease problem in vegetable production. Scientific Publishers, Jodhpur.
8. Singh, R.S. 2012. Diseases of Fruit Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
9. Singh, R.S.1998. Diseases of Vegetable Crops. 3rd ed. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

HORT-321	Post-harvest Management and Value Addition of Fruits and Vegetables	2(1+1)

Theory

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; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning –- Concepts and Standards, packaging of products.

Practical

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. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Importance of post-harvest processing of fruits and vegetables	**1**
2.	Extent and possible causes of post harvest losses	**1**
3.	Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening	**1**
4.	Respiration and factors affecting respiration rate	**1**
5.	Maturity indices**,** Harvesting and field handling	**1**
6.	Storage (ZECC, cold storage, CA, MA, and hypobaric)	**1**
7.	Value addition concept; Principles and methods of preservation	**2**
8.	Intermediate moisture food- Jam, jelly, marmalade	**1**
9.	Preserve, candy – Concepts and Standards	**1**
10.	Fermented and non-fermented beverages	**2**
11.	Tomato products- Concepts and Standards	**1**
12.	Drying/Dehydration of fruits and vegetables – Concept and methods, osmotic drying	**1**
13.	Canning - Concepts and Standards, packaging of products	**2**

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Identification and applications of different types of packaging, containers for shelf life extension	**1**
2.	Identification of important tools/equipments/ machines and chemicals required for PHT laboratory	**1**
3.	Demonstration of Zero energy cool chamber	**1**
4.	Effect of temperature on shelf life and quality of produce (drying and dehydration)	**1**
5.	Demonstration of chilling and freezing injury in vegetables and fruits	**1**
6.	Extraction and preservation of pulps and juices	**1**
7.	Preparation of Jam and Jelly	**1**

8.	Pickles	**1**
9.	RTS, nectar and squash	**1**
10.	Osmotically dried products	**1**
11.	Fruit bar and Candy	**1**
12.	Tomato products (sauce and ketchup)	**1**
13.	Canned products	**1**
14.	Quality evaluation of products - physico-chemical (Moisture, TSS, acidity and ascorbic acid) and sensory	**2**
15.	Visit to processing unit/ industry.	**1**

Reference Books

S. No.	Title of Book	Author	Publisher
1	Post Harvest Technology of Flowers and Ornamentals Plants (2005)	Battacharjee, S. K. and De, L. C	Pointer Publisher
2	A Handbook on Post Harvest management of Fruits and vegetables (2008)	Jacob John, P	Daya Publishing House, Delhi
3	Food Preservation & Processing (1996)	Manoranjan, K and Sangita, S.	Kalyani Publishers
4	Post Harvest Physiology and Storage of Tropical and Sub-tropical Fruits (1997)	Mitra, S. K.	CAB International
5	Principles of Fruit Preservation (2006)	Morris, T. N.	Biotech Books, Delhi
6	Post harvest Management of Horticultural Crops (2008)	Saraswathy, S. et. al.	Agribios
7	Fruits and vegetable Preservation – Principles and Practice (2002)	Srivastava, R. P. & Sanjeev Kumar	International Book Distributing Co., Lucknow
8	Post Harvest Technology of Fruits and Vegetables Vol. I & II. (2000)	Verma, L. R. and Joshi, V. K.	Indus Publishing Co., New Delhi
9	Text Book of Food Sciences and Technology (2001)	Vijay, K.	ICAR
10	Post Harvest management of Horticultural crops	Mayani, Desai, Vagadia	Jaya Publishing House
11	Good management Practices for Horticultural Crops	Ed. M.K. Jatav, etal.	NIPA
12	Post Harvest management & Processing of fruits & vegetables- Instant notes	Sharma, Satish	NIPA
13	Post Harvest of Horticultural Crops- Practical manual Series Vol.2	Sharma, Satish	NIPA
14	Fruit and Vegetable Phytochemicals: Chemistry, Nutritional Value and Stability	Rosa L.A.	BioGreen
15	Handling, transportation and Storage of Fruits & Vegetables Vol.1 2nd Ed (Vegetables & Melons)	Ryall, A.	Sci Int

16	Handling, transportation and Storage of Fruits & Vegetables Vol.2, 2nd Ed (Fruits & tree nuts)	Ryall, A.	Sci Int
17	Laboratory Manual of Analytical Techniques in Horticulture	Saini, R.	Agro Bot
18	Nutritional Value and Health benefits from fruits, vegetable, nuts & spices	Chavan, U.	Daya
19	Olive: Improvement, Production and Processing	Lal, S.	Astral
20	Ornamental Plants and Garden Design in Tropics and subtropics, Vol-2 sets	Bose, T.	Daya
21	Post Harvest Technology of fruits and Vegetables	Sasikaumar, R.	Biotech

ENTO-321	**Management of Beneficial Insects**	**2(1+1)**

Theory

Part - I

Beekeeping- Importance, bee species and biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication.

Sericulture- Importance, species of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pests and diseases of silkworm.

Lac culture- Importance, species of lac insect, morphology, biology, host plants, lac production- seed lac, button lac, shellac, lac-products.

Part - II

Insect orders bearing parasitoids and predators used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers with their importance.

Practical

Honeybee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Species of silkworm, voltinism of silkworm. Knowledge of mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Beekeeping- Importance, bee species and biology.	2
2.	Commercial methods of rearing, equipment used, seasonal management.	1
3.	Bee enemies and diseases.	1
4.	Bee pasturage, bee foraging and communication.	1
5.	Importance, species of silkworm, voltinism and biology.	1
6.	Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.	1

7.	Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm.	1
8.	Importance, species of lac insect, morphology, biology, host plants, lac production- seed lac, button lac, shellac, lac- products.	2
9.	Insect orders bearing parasitoids and predators used in pest control.	2
10.	Mass multiplication techniques of parasitoids (*Trichogramma chilonis* and *Campoletis chloridae*) and predators (ladybird beetle).	3
11.	Important species of pollinators, weed killers and scavengers with their importance.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Honey bee species, castes of bees.	1
2	Beekeeping appliances and seasonal management, bee enemies and disease.	2
3	Bee pasturage, bee foraging and communication.	1
4	Types of silkworm, voltinism of silkworm.	1
5	Knowledge of mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves.	1
6	Species of lac insect, host plant identification.	1
7	Identification of important parasitoids, predators, pollinators, weed killers and scavengers.	1
8	Collection of important parasitoids, predators, pollinators, weed killers and scavengers.	2
9	Mass multiplication techniques of parasitoids (*Trichogramma chilonis* and *Campoletis chloridae*) and predators (ladybird beetle).	4
10	Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.	2

Reference Books

1. DeBach, P. 1974. Biological control by Natural enemies. Cambridge University Press.
2. Dhaliwal GS & Arora R. 2001. Integrated Pest Management: Concepts and approaches. Kalyani Publ., New Delhi.
3. Dhaliwal, GS & Koul O. 2007. Biopesticides and Pest Management. Kalyani Publ., New Delhi.
4. Gautam, R.D. Biological Pest Suppression, Westvill Publising Co., New Delhi.
5. Manfred Mackaur, Laster E.Ehler and Jens Roland. 1990. Critical Issues in Biological control- Intercept Ltd. Project Directorate of Biological control. 1994. Technology for mass production of Natural enemies. Technical Bulletin -4.
6. Srivastava, K.P. 2004. A Text Book of Entomology, Vol. I, Kalyani Publishers, New Delhi.
7. Abrol, D.P. 2013. Beekeeping: A Comprehensive Guide to Bee and Beekeeping, Scientific Publishers, Jodhpur.

GPB-321	Crop Improvement-II *(Rabi crops)*	2 (1+1)

Theory

Centers of origin, distribution of species, wild relatives in different cereals(Wheat, Oat and Barley); pulses(Chickpea, Lentil and Field pea); oilseeds (Rapeseed Mustard and Sunflower); fodder crops (Berseem) and cash crops (Sugarcane); vegetable and horticultural crops (Potato); Plant genetic resources, its utilization and conservation; Floral biology, study

of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops. Hybrid seed production technology of rabi crops. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rapeseed Mustard, Sunflower, Potato, Berseem. Sugarcane, Cowpea; 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 Rabi crops; 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; Visit to AICRP plots of different field crops.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Crop improvement aspects in **Wheat** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
2	Crop improvement aspects in **Oat** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
3	Crop improvement aspects in **Barley** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
4	Crop improvement aspects in **Chickpea** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
5	Crop improvement aspects in **Lentil** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
6	Crop improvement aspects in **Pigeonpea** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production.	1
7	Crop improvement aspects in **Field pea** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
8	Crop improvement aspects in **Rapeseed Mustard** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc. (2 lectures)	1
9	Crop improvement aspects in **Rapeseed Mustard** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production	1
10	Crop improvement aspects in **Sunflower** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
11	Crop improvement aspects in **Berseem** and **potato** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc & hybrid seed production.	1
12	Crop improvement aspects in **Sugarcane** as mentioned in the syllabus such as Centers of origin, distribution of species Floral biology breeding objectives and procedures etc.	1
13	Modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional	1

14	Seed production technology in self pollinated, cross pollinated and vegetatively propagated crops	1
15	Ideotype concept	1
16	Climate resilient crop varieties for future.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Emasculation and hybridization techniques in Wheat, Oat, Barley	1
2	Emasculation and hybridization techniques in Chickpea, Lentil, Field pea	1
3	Emasculation and hybridization techniques in Rapeseed Mustard	1
4	Emasculation and hybridization techniques in Sunflower, Potato	1
5	Emasculation and hybridization techniques in Berseem. Sugarcane	1
6	Maintenance breeding of different rabi crops.	1
7	Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods.	1
8	Study of field techniques for seed production and hybrid seeds production in *rabi* crops	1
9	Estimation of heterosis, inbreeding depression and heritability	1
10	Layout of field experiments	1
11	Study of quality characters	1
12	Donor parents for different characters	1
13	Visit to seed production plots	2
14	Visit to AICRP plots of different field crops.	2

Reference Books

1. Chopra, V.L. 2000 Breeding of Field Crops (Edt.). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Chaddha. K.L. and Rajendra Gupta. 1995. Advances in Horticulture Vol. II Medicinal and Aromatic Plant. Malhotra Publishing House, New Delhi.
3. Mandal, AK., P.K. Ganguli and S.P. Banerjee. 1991. Advances in Plant Breeding Vol. I and II. CBS Publishers and Distributors, New Delhi.
4. Manjit S. Kang 2004. Crop Improvement: Challenges in the Twenti-First Century (Edt). International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co.. INC, East Port, Conneacticut, USA.
6. Ram, H.H. and H.G. Singh. 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
7. Sharma, A.K. 2005. Breeding Technology of Crop Plants (Edt.). Yash Publishing House, Bikaner.
8. Ram. H.H. 2005. Vegetable Breeding — Principles and Practices. Kalyani Publishers, New Delhi.

AGRON-322	Practical Crop Production – II (Rabi crops)	1(0+1)

Practical

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

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Allotment of land and field preparation	1
2.	Sowing methods	1
3.	Selection of crops and varieties	1
4.	Seed treatment	1
5.	Preparation of seed bed and sowing of crops	1
6.	Thinning and gap filling	1
7.	Fertilizer application including top dressing of fertilizers	1
8.	Intercultural operations- hoeing and weeding	1
9.	Intercultural operations- hoeing and weeding	1
10.	Application of moisture conservation practices	1
11.	Insect and pest management /control –application of insecticides.	1
12.	Disease management/control –application of fungicides	1
13.	Harvesting of the crops	1
14.	Threshing, winnowing and storage	1
15.	Marketing of produce	1
16.	Preparation of balance sheet including cost of cultivation and net return per student as well as team of a group of student	1

Reference Books

1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition), Agri-Horticultural Publishing House, Nagpur.
2. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur.
3. Reddy, S. R. 2016. Principles of Agronomy (5th edition), Kalyani Publishers, Ludhiana.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.

AGRON-323	Principles of Organic Farming	2(1+1)

Theory

Organic farming, principles 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, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1.	Organic farming, principles and its scope in India;	2
2.	Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture;	1
3.	Organic ecosystem and their concepts;	1
4.	Organic nutrient resources and its fortification;	1
5.	Restrictions to nutrient use in organic farming;	1
6.	Choice of crops and varieties in organic farming;	1
7.	Fundamentals of insect, pest, disease mgt	2
8.	weed management under organic mode of production;	1
9.	Operational structure of NPOP	2
10.	Certification process and standards of organic farming;	2
11.	Processing, leveling, economic considerations and viability,	1
12.	marketing and export potential of organic products	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1.	Visit of organic farms to study the various components and their utilization;	2
2.	Preparation of enrich compost,	2
3.	vermicompost,	2
4.	bio-fertilizers/bio-inoculants and their quality analysis;	2
5.	Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management;	2
6.	Cost of organic production system;	2
7.	Post harvest management;	2
8.	Quality aspect, grading, packaging and handling.	2

Reference Books

1. Dhama, A.K. 2014. Organic Farming for Sustainable Agriculture (2nd edition), Agrobios (India), Jodhpur.
2. Sharma, Arun K. 2013. A Handbook of Organic Farming, Agrobios (India), Jodhpur
3. Palaniappan, S.P. and Anandurai, K.1999. Organic Farming – Theory and Practice. Scientific Pub. Jodhpur
4. Thapa, U and Tripathy, P. 2006. Organic Farming in India, Problems and prospects, Agrtech, Publising Academy, Udaipur.
5. शर्मा, अरूण के. 2015. जैविक खेती – नई दिशाए, एग्रोबायोस (इण्डिया), जोधपुर

AGECON-321	Farm Management, Production & Resource Economics	2(1+1)

Theory

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. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting. Introduction to linear programming. Concept of risk and uncertainty in agriculture production, nature and sources of risks Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, types of natural resources, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

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. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of 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 Rajasthan.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Meaning and concept of farm management, objectives and relationship with other sciences.	1
2	Meaning and definition of farms, its types and characteristics, factor determining types and size of farms.	1
3	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.	3
4	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.	2
5	Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.	1
6	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.	2
7	Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting.	1
8	Introduction to linear programming.	1
9	Concept of risk and uncertainty in agriculture production, nature and sources of risks Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation.	2

10	Concepts of resource economics, types of natural resources, differences between NRE and agricultural economics, unique properties of natural resources.	1
11	Positive and negative externalities in agriculture, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Preparation of farm layout.	2
2	Determination of cost of fencing of a farm.	1
3	Computation of depreciation cost of farm assets.	2
4	Application of equi-marginal returns/opportunity cost principle in allocation of farm resources.	1
5	Determination of most profitable level of inputs use in a farm production process.	1
6	Determination of least cost combination of inputs.	1
7	Selection of most profitable enterprise combination.	2
8	Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises.	2
9	Preparation of farm plan and budget, farm records and accounts and profit & loss accounts.	2
10	Collection and analysis of data on various resources in Rajasthan.	2

References Books

1. Mittal, S.K. and Sethi, C.P. "Linear Programming."
2. Tandan, R.K. and Dhondiyal, S.P. "Principles and Methods of Farm Management".
3. Heady, E.O. and Candler, W. "Linear Programming Methods."
4. Johl, S.S. and Kapoor, T.R. "Fundamental of Farm Business Management, Kalyani Publishers, Ludhiana and New Delhi
5. Sankhayan, P.L "Introduction to the Economics of Agricultural Production."
6. Singh, I.J. "Elements of Farm Management"
7. Dorfman, R. and Samuelson and Solow, R. "Linear Programming and Economic Analysis."
8. Heady, E.O. and Dillors, J.L."Agricultural Production Function".
9. Karam, A.S. and Karan Singh "Economics of Farm Management in India".
10. M.E. Sharpe and Armonk, N.Y.: Environmental and Natural Resource Economics: Theory, Policy and the Sustainable Society
11. Hartieick, J.M. and Olewiler, N.D.: The Economics of Natural Resource Use

HORT-322	Principles of Food Science & Nutrition	2(2+0)

Theory

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 and 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.

Lecture Schedule – Theory

S. No.	Title of Topic	Cr. Hrs.
1	Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.);	4
2	Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions);	5
3	Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods);	5
4	Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.);	5
5	Food and nutrition,	2
6	Malnutrition (over and under nutrition),	2
7	Nutritional disorders;	3
8	Energy metabolism (carbohydrate, fat, proteins);	2
9	Balanced/ modified diets,	1
10	Menu planning,	1
11	New trends in food science and nutrition.	2

Reference Books

1. Yiu,H. and Hui (2006).Hand Book of Food Science,Technology and Engineering
2. Swaminathan, M. Hand Book of Food and Nutrition
3. Sumati R Mudamb ,Fundamental of Foods, Nutrition and Diet Therapy

GPB-322	Micro-propagation Technology (Elective Course)	3(2+1)

Theory

Meaning and concept of in vitro culture and micro-propagation; Historical milestones, advancement and future prospects of micro-propagation; totipotency, dedifferentiation; Tissue culture methodology: Sterile techniques, synthetic and natural media components, growth regulators, environmental requirement, genetic control of regeneration; Plant regeneration pathways - Organogenesis and Somatic embryogenesis;

Micro-propagation- Definition, methods, stages of micro-propagation and its significance; Axillary bud proliferation approach- Shoot tip and meristem culture; Organogenesis- Purpose, methods and requirements for organogenesis, indirect and direct organogenesis; Somatic embryogenesis- Procedures and requirements for organogenesis, indirect and direct embryogenesis; Differences between somatic and gametic embryogenesis, Synthetic seed-Concepts, necessity, procedure and requirements for production of synthetic seeds.

Practical

Laboratory organization, sterilization techniques for explants, glassware, plastic wares, lab wares and working platform. Preparation of stocks and working solution. Preparation and sterilization of growth regulators.

Preparation of working medium and experimentation on determining optimum concentration of growth regulators. Callus induction and regeneration of whole plants from different parts of plants. Direct regeneration into whole plants using bud, node and other tissues.

Induction of somatic embryos. Experiments of synthetic seeds production and testing storability and germination efficiency.

Lecture Schedule-Theory

S. No.	Title of Topic	Cr. Hrs.
1	Meaning and concept of *in vitro* culture and micro-propagation	1
2	Historical milestones of *in vitro* culture and micro-propagation	1
3	Advancement and future prospects of micro-propagation	1
4	Totipotency, dedifferentiation	1
5	Tissue culture methodology: Sterilization techniques	1
6	Synthetic and natural media components	1
7	Growth regulators used in tissue culture media	1
8	Environmental requirement	1
9	Genetic control of regeneration	1
10	Plant regeneration pathways- Organogenesis and Somatic embryogenesis;	1
11	Micro-propagation- Definition, methods, stages of micro-propagation and its significance	1
12	Axillary bud proliferation approach- Shoot tip and meristem culture	1
13	Organogenesis- Purpose, methods and requirements for organogenesis, indirect and direct organogenesis	1
14	Somatic embryogenesis- Procedures and requirements for organogenesis, indirect and direct embryogenesis	1
15	Differences between somatic and gametic embryogenesis,	1
16	Synthetic seed-Concepts, necessity, procedure and requirements for production of synthetic seeds.	1

Practical Schedule

S. No.	Title of Practical Exercise	Cr. Hrs.
1	Laboratory organization	1
2	Sterilization techniques for explants	2
3	Sterilization techniques for glassware	2
4	Sterilization techniques for plastic wares	2
5	Sterilization techniques for lab wares	2
6	Sterilization techniques for working platform	2
7	Preparation of stocks and working solution	1
8	Preparation of stocks and working solution	1
9	Preparation and sterilization of growth regulators.	1
10	Preparation of working medium	2
11	Experimentation on determining optimum concentration of growth regulators.	2
12	Callus induction and regeneration of whole plants from different parts of plants.	4
13	Direct regeneration into whole plants using bud	2
14	Direct regeneration into whole plants node	2
15	Direct regeneration into whole plants other tissues	2
16	Induction of somatic embryos	1
17	Experiments of synthetic seeds production	1
18	Testing storability of synthetic seed	1
19	Germination efficiency of synthetic seed	1

Reference Books

1. Chawala H S (2000) Introduction to Plant Biotechnology. Oxford & IBH
2. Gupta, P. K. (2008) Elements of biotechnology Rastogi publications meerut
3. Ray V. Herren (2005)Introduction to biotechnology (An Agricultural revolution)
4. Shekhawat, MS (2011) Plant Biotechnology, In vitro princioles, Techniques and Applications, MJP Publishers, Chennai
5. Mascarenhas, A. F. (2008) Hand book of Plant tissue Culture, ICAR.
6. Singh BD. 2005. Biotechnology, Expanding Horizons. Kalyani.

B. Sc.(Hons.) Agriculture, Part-IV
VII Semester

S. No.	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE &AIA)		
	Activities	**No. of weeks**	**Credit Hours**
1	General orientation & On campus training by different faculties	1	14
2	Village attachment	8	
	Unit attachment in Univ./ College. KVK/ Research Station Attachment	5	
3	Plant clinic	2	2
	Agro-Industrial Attachment	3	4
4	Project Report Preparation, Presentation and Evaluation	1	
	Total weeks for RAWE & AIA	20	20

- **Agro- Industrial Attachment:** The students would be attached with the agro-industries for a period of 3 weeks to get an experience of the industrial environment and working.

RAWE **Component-I**

Village Attachment Training Programme

S. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	1 week
7	Animal Production Interventions	1 week
8	Extension and Transfer of Technology activities	1 week

RAWE **Component –II**

Agro Industrial Attachment

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post harvest-processing-value addition, Agri-finance institutions etc.

Activities and Tasks during Agro-Industrial Attachment Programme

- Acquaintance with industry and staff
- Study of structure, functioning, objective and mandates of the industry

- Study of various processing units and hands-on trainings under supervision of industry staff
- Ethics of industry
- Employment generated by the industry
- Contribution of the industry promoting environment
- Learning business network including outlets of the industry
- Skill development in all crucial tasks of the industry
- Documentation of the activities and task performed by the students
- Performance evaluation, appraisal and ranking of students

B. Sc.(Hons.) Agriculture, Part-IV
VIII Semester

Modules for Skill Development and Entrepreneurship: A student will have to be registered for 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the VIII semester, to be decided later on from the modules listed below or as per the sanction of EL units from ICAR and available existing facilities.

S.No.	Title of the module	Credits
1	Production Technology for Bioagents and Biofertilizer	0+10
2	Seed Production and Technology	0+10
3	Mushroom Cultivation Technology	0+10
4	Soil, Plant, Water and Seed Testing	0+10
5	Commercial Beekeeping	0+10
6	Poultry Production Technology	0+10
7	Commercial Horticulture	0+10
8	Floriculture and Landscaping	0+10
9	Food Processing	0+10
10	Agriculture Waste Management	0+10
11	Organic Production Technology	0+10
12	Commercial Sericulture	0+10

Evaluation of Experiential Learning Programme/ HOT

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

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