University of Technology

Serving Education Since 1976

School of

Agriculture

Syllabus of

B.Sc Agriculture

B.Sc. (Hons.) Agriculture

Semester wise distribution of courses

I Semester

Course No.	Course Title	Credits
AGRON 4111	Introductory Agriculture and Principles of Agronomy	3(2+1)
PBG 4111	Principles of Genetics	3(2+1)
SCHEM 4111	Introduction to Soil Science	3(2+1)
EXTED 4111	Dimensions of Agricultural Extension	2(1+1)
PPATH 4111	Agricultural Microbiology	3 (2+1)
COMP 4111	Introduction to Computer Applications	2(1+1)
MATHS 4111	Elementary Mathematics	2(2+0)
ENG 4111	Comprehensive and Communication Skills in English	3 (2+1)
NSNC 4221	NCC/NSS/ Physical Education	----
	Total	21(14+7)

II Semester

Course No.	Course Title	Credits
AGRON 4121	Agricultural Meteorology	2 (1+1)
PBG 4121	Principles of Plant Breeding	3(2+1)
PPATH 4121	Plant Pathogens and Principles of Plant Pathology	4 (3+1)
ENTO 4121	Insect Morphology and Systematics	3 (2+1)
AGECON 4121	Principles of Agricultural Economics	2 (2+0)
AENGG 4121	Fundamentals of Soil and Water Conservation Engineering	2(1+1)
BIOCH 4121	Biochemistry	3 (2+1)
SCHEM 4121	Soil Chemistry, Soil Fertility and Nutrient Management	2(1+1)
	Total	21(14+7)

III Semester

Course No.	Course Title	Credits
AGRON 4211	Field Crops-I (*Kharif*)	3 (2+1)
AGRON 4212	Weed Management	2 (1+1)
NEMAT 4211	Introductory Nematology	2 (1+1)
STAT 4211	Statistics	3(2+1)
EXTED 4211	Fundamentals of Rural Sociology and Educational Psychology	2(2+0)
HORT 4211	Production Technology of Fruits and Plantation Crops	3(2+1)
AGECON 4211	Production Economics and Farm Management	2 (1+1)
AENGG 4211	Farm Power and Machinary	2(1+1)
SCHEM 4211	Manures And Fertilizers	2 (1+1)
NSNC 4211	NCC/NSS	
	Total	21(13+8)

IV Semester

Course No.	Course Title	Credits
AGRON 4221	Field Crops- II (*Rabi*)	3 (2+1)
AGRON 4222	Water Management	2 (1+1)
SCHEM 4221	Soil survey, Land Use Planning and Remote Sensing	2(1+1)
ENTO 4221	Insect Ecology and Integrated Pest Management including Beneficial Insects	3(2+1)
HORT 4221	Production Technology of Vegetables and Flowers	4(3+1)
AGECON 4221	Agricultural Finance and Co-operation	2(1+1)
PPHYS 4221	Crop Physiology	3(2+1)
EXTED 4221	Entrepreneurship Development and Communication Skills	2(1+1)
NSNC 4221	NSS/ NCC*	1(0+1)
	Total	22(13+9)

*shall be offered from I to IVth semester and evaluation will be reported at the end of IVth semester

V Semester

Course No.	Course Title	Credits
AGRON 4311	Practical Crop Production -1(*Kharif* crops)	1 (0+1)
AGRON 4312	Rainfed Farming	2 (1+1)
BT 4311	Principles of Plant Biotechnology	3(2+1)

ENTO 4311	Crop and stored grain pests and their management	4(3+1)
PBG 4311	Breeding of Field and Horticultural Crops	3(2+1)
AGECON 4311	Agricultural Marketing, trade and Prices	2(1+1)
AENGG 4311	Protected cultivation and Post harvest Technology	2(1+1)
PPATH 4311	Diseases of Field Crops and their management	3(2+1)
HORT 4311	Production technology of Spices, Aromatic and Medicinal crops	2(1+1)
	Total	22(13+9)

VI Semester

Course No.	Course Title	Credits
AGRON 4321	Practical Crop Production –II *(Rabi)*	1 (0+1)
AGRON 4322	Farming Systems, Sustainable Agriculture and Organic Farming	3 (2+1)
PBG 4321	Principles of Seed Technology	3(2+1)
EXTED 4321	Extension Methodologies for Transfer of Agricultural Technology	2(1+1)
LPM 4321	Livestock Production and Management	3(2+1)
ENVS 4321	Environmental Science**	3(2+1)
HORT 4321	Post harvest management and value addition of fruits and vegetables	3(2+10
PPATH 4321	Diseases of Horticultural Crops and their management	2(1+1)
AGECON 4321	Fundamentals of Agri. Business Management	2(1+1)
	Total	22(13+9)

** shall be shared between Biochemistry, Entomology and Soil Science

VII Semester

(Elective/ Experiential learning courses)

Group	Course No.	Course Title	Credits
Crop Production and Allied Disciplines	PBG 4411	Advanced Seed Technology	3(1+2)
	AGRON 4411	Applied Weed Management	3(1+2)
	SCHEM 4411	Vermi-composting and Organic farming	3(1+2)
	SCHEM 4412	Soil, Plant and Water Analysis	3(1+2)
	SCHEM 4413	Soil Management	3(1+2)
	LPM 4411	Dairy Cattle Production	3(1+2)
	PPHYS 4411	Plant Growth regulators in Agriculture	3(1+2)
	AENGG 4411	Plasticulture in Agriculture	3(1+2)
Plant Sciences and Plant Protection	PBG 4411	Advanced Seed Technology	3(1+2)
	PBG 4412	Tissue culture and Micro-propagation techniques	3(1+2)
	PPATH 4411	Bio-agents and Integrated Disease Management	3(1+2)
	PPATH 4412	Detection and Management of seed borne pathogens	3(1+2)
	ENTO 4411	Non –Insect Pests and their management	3(1+2)
	ENTO 4412	Bio-control agents and Bio-pesticides	3(1+2)
	PPHYS 4411	Plant Growth regulators in Agriculture	3(1+2)
	NEMAT 4411	Economic Nematology	3(1+2)
Horticulture and Allied Sciences	ENTO 4412	Bio-control agents and Bio-pesticides	3(1+2)
	SCHEM 4411	Vermi-composting and Organic farming	3(1+2)
	PBG 4412	Tissue culture and Micro-propagation techniques	3(1+2)
	AENGG 4411	Plasticulture in Agriculture	3(1+2)
	HORT 4411	Nursery Management of Horticultural Crops	3(1+2)
	HORT 4412	Commercial Vegetable Production	3(1+2)
	HORT 4413	Commercial Fruit Production	3(1+2)
	PPHYS 4411	Plant Growth regulators in Agriculture	3(1+2)
Social Sciences	AGECON 4411	Marketing Management	3(2+1)
	AGECON 4412	Project Formulation, Evaluation and Monitoring	3(1+20
	AGECON 4413	Natural Resource Economics and Management	3(2+1)
	EXTED 4411	Visuals and Graphic Communications	3(1+2)
	EXTED 4412	Govt. Policies and Priogrammes on Agriculture	3(1+2)
	STAT 4411	Sampling Techniques	3(1+2)
	LPM 4411	Dairy Cattle Production	3(1+2)
	LPM 4412	Poultry Production and Management	3(1+2)

Note: A student shall be required to offer six courses of 18 credits out of the eight listed in any one of the groups. The individual college will have an option to offer six courses out of the groups to be offered. The student can offer courses from a single group only for which he/she shall be required to submit preference for these groups and no *inter-alia* group courses will be permitted.

VIII Semester

Rural Agricultural Work Experience (RAWE)

Programme	Duration (Weeks) credits
Orientation	1 (Non Credit)
Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	6 (6 credits)
In-situ interaction of farmers, college faculty and students	2 (in two splits)(2 credits)
Industrial Attachment*/Skill Development/Experiential Learning Courses	8 (8 credits)
Educational Tour	2 (2 credits)
Project Report Preparation and Evaluation	1 (Non Credit)

*Industrial attachment shall include attachment with any of the following industries/Organisations

1. Seed industries/ companies
2. Fertilizer industries/companies
3. Pesticide industries/companies
4. Biotechnological industries/companies
5. Tissue culture laboratories
6. Bio-Pesticide industries
7. Commercial nurseries/land scaping units
8. Food processing units
9. Agricultural finance institutions/banks/credit societies, etc
10. NGOs

Rural Agricultural Work Experience (RAWE) **18(0+18)**

Grand total (I to VIII Semester) **165(86+79)**

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

I Semester

AGRON 4111 Introductory Agriculture and Principles of Agronomy 3 (2+1)

Theory:

Definition and importance of Agriculture; Meaning and scope of Agronomy; Plant growth and development– concept and differences; general growth curves, factors affecting crop production, Classification of crops; Meaning and types of tillage and tilth; Soil fertility and productivity ; Soil erosion- nature, extent and types; Soil conservation- meaning , agronomic and common mechanical practices; Agro-climatic zones of Rajasthan and India and National, International Agricultural Research Institutes in India and abroad. Art, science and business of crop production; Agricultural heritage; Chronological agricultural technology development in India; Ancient Indian Agriculture in Civilization Era; Conversion of man from food gatherer to food producer; Development of Agriculture through Kautilya`s work; Tools to predict monsoon rain; Plant protection in ancient and medieval India; Forest management and products, history of some indigenous trees.

Practical:

Identification of crop seeds and plants; Identification of fertilizers and manures; Acquaintance with farm tools and implements; Methods of ploughing and sowing; Preparation of seed beds of crops; Calculation on plant population ; Calculation of soil and water losses from runoff plots ; Identification of grasses, legumes and trees for soil conservation.

Lecture schedule : Theory

S.No.	Topic	No. of lectures
1.	Agriculture-definition and importance of agriculture	1
2.	Agronomy-meaning and scope of Agronomy	1
3.	Plant growth and development-concept and differences and sigmoid growth curve	1
4.	Factors affecting crop production-genetic, climatic and edaphic	1
5.	Classification of crops-botanical, agronomic, seasonal.	1
6.	Classification of crops based on life span, special purposes i.e. cover, green manure, catch, trap, cash, soiling.	1
7.	Tillage-definition and types of tillage including minimum and no tillage.	1
8.	Tilth-definition and characteristics of good tilth.	1
9.	Soil fertility and productivity-definition and differences	1
10.	Soil erosion-definition, nature and extent of erosion in Rajasthan and India	1
11.	Types of soil erosion-geological and accelerated erosion.	1
12.	Types of water erosion	1
13.	Types of wind erosion	1
14.	Agronomic practices for control of wind erosion.	1
15.	Agronomic practices for control of water erosion.	1
16.	Soil conservation-meaning and importance	1
17.	Agronomic practices for soil and water conservation	1
18.	Mechanical practices for soil and water conservation	1
19.	Agroclimatic zones of Rajasthan – a brief introduction.	1
20.	Agroclimatic zones of India– a brief introduction	1
21.	National agricultural research institutes in India.	1
22.	International agricultural research institutes in India and abroad.	1
23.	Art, science and business of crop production- a brief introduction.	1
24.	Agricultural heritage	1
25.	Chronological agricultural technology development in India .	1
26.	Ancient Indian agriculture in civilization era.	1
27.	Conversion of man from food gatherer to food producer.	1
28.	Development of agriculture through Kautilya`s work-agriculture	1
29.	Development of agriculture through Kautilya`s work-animal husbandry	1
30.	Traditional tools to predict monsoon rains: Parashara, *Panchangas*	1
31.	Plant protection through *Vrikshayurveda* and traditional knowledge	1
32.	Forest management and products-history of some indigenous trees.	1

Lecturer schedule: Practical

S.No.	Topic	No. of lectures
1	Visit to College farm	1
2	Identification of seeds of major crops	1
3	Identification of crop plants	1
4	Classification and identification of manures and fertilizers	1
5	Acquaintance with farm tools and implements	1
6	Working out seed rate of different crops	1
7	Ploughing and preparation of field	1
8	Sowing of crops	1
9	Calculation of plant population	1
10	Thinning of crop plants	1
11	Inter cultivation in crops of the season	1
12	Preparation of seed beds-ridge and furrow method	1

13	Preparation of seed bed- check basin	1
14	Calculation of soil and water losses from runoff plots.	1
15	Identification of grasses and legumes for soil conservation	1
16	Identification of trees for soil conservation.	1

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2. ICAR 1989 Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi
3. Michael, A.M. and Ojha, T.P. 1986. Principles of Agricultural Engineering, Vol.II Jain Brothers, New Delhi.
4. Morachan, Y.B. 1986, Crop production and management, Oxford & IBH Publishing Co., New-Delhi.
5. Porwal, B.L. and Sharma, D.D. 1991. Sashya Vigyan Ke Adhunic Siddhant (Hindi) Alka Publishers, Ajmer.
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11. Nene, Y.L. and Choudhary, S.L. 2002. Agricultural Heritage in India. Asian Agri-History Foundation (AAHF), Secunderabad, Rajasthan Chapter of AAHF, Udaipur.
12. Nene, Y.L. 2007. Glimpses of the Agricultural Heritage of India. Asian Agri- Histroy Foundation, Secunderabad, Andhra Pradesh.
13. Choudhary, S.L., Sharma, G.S. and Nene, Y.L. 2000. Ancient and Medieval History of Indian Agriculture. Rajasthan College of Agriculture, Udaipur, Rajasthan.

PBG 4111 Principles of Genetics 3 (2+1)

Theory:

History of Genetics, ultra structure of cell. Cell organelles and their function. Chromosomes structure, function and their chemical composition-karyotype and ideogram. Cell division: types and their significance. Mendel's law of inheritance. Gene interaction and their types. Multiples alleles and some classical examples. Inheritance of qualitative and quantitative characters and difference between them. Multiple factor hypothesis.Pleiotropism, penetrance and expressivity. Mechanism of crossing over and cytological proof of crossing over. Linkage types and importance. Estimation of linkage. DNA and its structure, function, types, mode of replication and repair.RNA and its structure,function and its types, transcription,translation,genetic code and protein synthesis.cytoplasmic inheritance-its characteristics features and difference between chromosomal and cytoplasmic inheritance.Structural chromosomal aberrations.Numerical chromosomal aberrations(polyploidy) and evolutionof different crop species like cotton,wheat,tobacco and brassicas.Mutation -characteristics , classification and induction.

Practical:

Introduction to microscopy-simple and compound microscope. study of typical plant cell. Preparation and use of fixatives and stains. Preparation of micro slides and identification of various stage of cell division. Monohybrid ratio and its modification. Test of goodness of fit of genetic ratio. Study of different types of gene interaction and modifications of typical dihybrid f_2 ratio. Study and detection of linkage in f_2 and test cross progeny. Demonstration of structural aberrations and polyploidy.

Lecture schedule: Theory

S. No.	Topic	No. of lectures
1.	History of Genetics, ultra structure of cell.	2
2.	Cell organelles and their function.	2
3.	Chromosomes structure, function and their chemical composition-karyotype and ideogram.	2
4.	Cell division: types and their significance.	1
5.	Mendel's law of inheritance.	2
6.	Gene interaction and their types. Multiples alleles and some classical examples.	2
7.	Inheritance of qualitative and quantitative characters and difference between them. Multiple factor hypothesis.	1
8.	Pleiotropism, penetrance and expressivity. Mechanism of crossing over and cytological proof of crossing over.	2
9.	Linkage types and importance. Estimation of linkage.	1
10.	DNA and its structure, function, types, mode of replication and repair.	3
11.	RNA and its structure, function and its types,	2
12.	Transcription, translation, genetic code and protein synthesis.	2
13.	Cytoplasmic inheritance-its characteristics features and difference between chromosomal and cytoplasmic inheritance.	2
14.	Structural chromosomal aberrations. Numerical chromosomal aberrations (polyploidy)	3
15.	Evolution of different crop species like cotton, wheat, tobacco and brassicas.	3
16.	Mutation -characteristics, classification and induction.	2

Lecture schedule: Practical

S. No.	Topic	No. of lectures
1	Introduction to microscopy-simple and compound microscope.	1
2	Study of typical plant cell.	1
3	Preparation and use of fixatives and stains.	2
4	Preparation of micro slides and identification of various stage of cell division.	4
5	Monohybrid ratio and its modification.	1
6	Test of goodness of fit of genetic ratio.	1
7	Study of different types of gene interaction and modifications of typical dihybrid f_2 ratio.	3
8	Study and detection of linkage in f_2 and test cross progeny.	1
9	Demonstration of structural aberrations and polyploidy.	2

References:

1. Gupta P.K.2004. Cytology, Genetics and evolution. Rastogi Publications, Meerut. (Hindi Edition)
2. Kaushik, M.P.2003. A text Book of Modern Botany. Prakash publications, Muzaffar nagar(UP)
3. Klug, W.W.AndCummings, M.R.2005.Concepts of genetics Pearson Education (Singapore) pvt. Ltd., Indian Branch, Pratap Ganj, New Delhi.
4. Singh, B.D. 2001.Kalyani Publishing House, New Delhi.
5. Strickberger, M.W.2001.Genetics. Prentice Hall of India. Pvt. Ltd., New Delhi.
6. Shekhawat, A.S.andTripathi, B.K., 2009. A practical manual on Element of Genetics. Publish by College of Agriculture, Bikaner.

SCHEM 4111 Introduction to Soil Science 3(2+1)

Theory:

Soil: Pedological and edaphological concepts. Origin of the earth, Earth's crust, Composition, Rocks and minerals. Weathering, Soil formation factors and processes, Components of soils. Soil profile, Soil physical properties, Soil texture, Textural classes, Particle size analysis, Soil structure, Classification, Soil aggregates, significance, Soil consistency, Soil crusting, Bulk density and particle density of soils & porosity and their significance and manipulation. Soil colour, Soil water, Retention and potentials, Soil moisture constants, Movement of soil water, Infiltration, Percolation, Permeability, Drainage. Methods of determination of soil moisture.Thermal properties of soils, Soil temperature, Soil air, Gaseous exchange, Influence of soil temperature and air on plant growth. Soil colloids: Properties, nature, types and significance; Layer silicate clays, and sources of charges. Adsorption of ions, Ion exchange, CEC & AEC, Soil reaction and buffering capacity. Factors influencing ion exchange and its Significance. Problem soils – acid, salt affected and calcareous soils,

characteristics. Reclamation – mechanical, chemical and biological methods. Irrigations water – Quality of irrigation water and its appraisal. Indian standards for water quality. Use of saline water for agriculture.

Practical:

Collection and processing of soil sample. Identification of rocks and minerals. Determination of bulk density and particle density, Soil moisture determination, Soil moisture constants – Field capacity, permanent wilting point, Water holding capacity Infiltration rate, Soil texture and mechanical analysis, Soil temperature, Soil analysis for CEC, pH, EC, soluble cations & anions.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Pedological and edaphological concepts	1
2.	Origin of earth crust, definition and composition	1
3.	Rocks and minerals and their classification	1
4.	Physical, chemical and biological weathering of rocks	2
5.	Factors of soil formation, fundamental and specific soil forming processes	2
6.	Components of soil and soil profile	1
7.	Soil Texture, classifications of soil separates, importance of soil texture, particle size analysis. Stoke's law	1
8.	Soil structure and types of soil structure, mechanism of soil structure formation, management of soil structure.	2
9.	Soil aggregate and its significance in agriculture and factors alternating stable soil aggregates	1
10.	Dry, moist and wet soil consistence, agricultural significance, factors affecting it, Atterberg's limit and constants of soil consistency	1
11.	Soil crusting and its formation and management	1
12.	Bulk density, particle density and porosity, factors affecting them, agricultural significance and manipulation	1
13.	Soil colour and expression of soil colour with munsell soil colour chart	1
14.	Soil water classification, forces of soil water retention and potential	2
15.	Movement of soil water-Infiltration, percolation, permeability and drainage and factors affecting it	2
16.	Methods of soil moisture determination :- Gravimetric method, Electrical resistance and Neutron scattering method	1
17.	Thermal capacity, conductivity and diffusivity, Soil temperature: and factors affecting soil temperature in relation to plant growth soil temperature in relation to plant growth	1
18.	Soil aeration ,gaseous exchange and its composition in relation to plant growth	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 and significance	1
22.	Adsorption of ions, soil reaction and buffering capacity	1
23.	Characteristics of acid, salt affected and calcarious soils	1
24.	Reclamation of acid, salt affected and calcarious soils	1
25.	Quality of irrigation water, appraisal, standards and use in agriculture	1

Lecture schedule—Practical

S. No	Topic	No. of lectures
1.	Collection and processing of soil samples and identification of rocks and minerals.	1
2.	Determination of soil aggregates	1
3.	Determination of bulk density of undisturbed soil by core sampler method.	1
4.	Determination of bulk density of disturbed soil by R D bottle methods	1
5.	Determination of particle density of soil by R D bottle and computation of porosity of soil	1
6.	Determination of lower and upper plastic limit of soil	1
7.	Determination of field capacity, permanent wilting point of soil and WHC	2
8.	Determination of infiltration rate of soil	1
9.	Mechanical analysis of soil by hydrometer method	1
10.	Determination of soil temperature	1

11.	Determination of CEC of soil	2
12.	Determination of pH and EC of soil and estimation of soluble cations and anions in soil extract	2
13.	Determination of gypsum requirement of sodic soil	1
14.	Determination of lime requirement of acid soil	1

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EXTED 4111 Dimensions of Agricultural Extension 2(1+1)

Theory:

Education- Meaning, Definition, Types-Formal, Informal and Non-formal Education. Extension Education - Meaning, Definition, Concept, Objectives, Principles, Scope and Importance. Development programmes of pre-independence era – Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme with special reference to year of start, objectives and activities. Development Programmes of post-independence era-Etawah Pilot Project, Community Development Programme–Meaning, Definition, Concept, Objectives, Difference between Community Development and Extension Education, National Extension Service. Panchayati Raj System/Democratic Decentralization/Three tiers system of Panchayati Raj–Concept,Meaning, Organizational set-up and Functions. Agricultural Development Programmes with reference to year of start, objectives & salient features- Institution Village Linkage Programme (IVLP), National Agricultural Technology Project (NATP), ATMA, ATIC, KVK & NAIP. Poverty Alleviation Programmes- Integrated Rural Development Programme (IRDP), Swarna Jayanti Gram Swarojgar Yojana (SGSY),National Rural employment act (NREGA). Reorganized Extension System (T & V System) – Concept & Methodology.

Practical:

Visit to KVK/ Extension Wing/ ATIC/ ATMA to study their functioning. Visit to Panchayati Raj Institutions to study the functioning of Gram Panchayat (GP) & Other Institutions. Visit and study the District Rural Development Agency (DRDA). Visit to a village to study the Self Help Groups (SHG). Visit to a voluntary organization to study the developmental activities. Organizing PRA techniques in a village to identify the agricultural problems.

Lecture schedule: Theory

S.No.	Topic	No.of lectures
1.	Education- Meaning, Definition, Types-Formal, Informal and Non-formal Education.	1
2.	Extension Education - Meaning, Definition, Concept, Objectives, Principles, Scope and Importance.	2
3.	Development programmes of pre-independence era– Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme with special reference to year of start, objectives and activities.	2
4.	Development Programmes of post-independence era-Etawah Pilot Project,	1
5.	Community Development Programme–Meaning, Definition, Concept,	1

	Objectives,Difference between Community Development and Extension Education,	
6.	National Extension Service.	1
7.	Panchayati Raj System/ Democratic Decentralization/ Three tiers system of Panchayati Raj – Concept, Meaning, Organizational set-up and Functions.	1
8.	Agricultural Development Programmes with reference to year of start, objectives & salient features- Institution Village Linkage Programme(IVLP),	1
9.	National Agricultural Technology Project (NATP), ATMA, ATIC, KVK & NAIP.	2
10	Poverty Alleviation Programmes- Integrated Rural Development Programme (IRDP), Swarna Jayanti Gram Swarojgar Yojana (SGSY)	2
11	National Rural employment act (NREGA).	1
12	Reorganized Extension System (T & V System) – Concept & Methodology.	1

Lecture schedule: Practical

S.No.	Topic	No.of lectures
1.	Visit to KVK/ Extension Wing/ ATIC/ ATMA to study their functioning.	3
2.	Visit to Panchayati Raj Institutions to study the functioning of Gram Panchayat (GP) & Other Institutions	3
3.	Visit and study the District Rural Development Agency (DRDA).	3
4.	Visit to a village to study the Self Help Groups (SHG).	2
5.	Visit to a voluntary organization to study the developmental activities.	3
6.	Organizing PRA techniques in a village to identify the agricultural problems.	2

References:

1. Dhama, O.P. & Bhatnagar, O.P.1985. Education and Communication for Development, Oxford & IBH Publishing Co. New-Delhi.
2. Kelsey, L.D. & Hearne, C.C. 1963. Cooperative Extension Work: Cornell University Press, New York, USA.
3. Ray, G.L. 2003. Extension Communication and Management, Naya Prakash, 206 Bidhan Sarni, Calcutta-6.
4. Reddy, A.A. 1993. Extension Education, Shri Laxmi Press, Baptala.

PPATH 4111 Agricultural Microbiology 3 (2+1)

Theory:

History of microbiology: Theory of spontaneous generation, role of microbes in fermentation, germ theory of disease, protection against infections. Applied areas of microbiology, Metabolism in bacteria: ATP generation, chemoautotrophy, photoautotrophy, respiration, fermentation. Bacteriophages: structure and properties - Lytic and lysogenic cycles: viroids, prions. Bacterial genetics: Genetic recombination, transformation, conjugation and transduction. Genetic engineering, plasmids, episomes, genetically modified organisms. Soil microbiology: microbial groups in soil; microbial transformations of carbon, nitrogen, phosphorus and sulphur; Biological nitrogen fixation. Plant microbe interaction.Rhizosphere and phyllosphere microflora. Beneficial microorganism in agriculture: biofertilizers – Rhizobium, mycorrhiza, azolla; microbial insecticides, microbial agents for control of plant diseases .Microbes in composting. Microbiology of water: marine water, fresh water, potable water; Food microbiology: microbial spoilage and food preservation. Biodegradation of pesticides.Biogas production.

Practical:

Acquaintance with equipments, glasswares *etc*. in microbiology laboratory. Acquaintance with microscope. Disinfection and sterilization methods. Preparation of culture media for fungi and bacteria. Isolation of microbes from infected plant parts. Isolation and purification of bacteria by streak plate method. Staining and slide preparation of fungi. Staining of bacteria- simple and differential staining. Staining of endospore. Determination of quality of milk sample by methylline blue reductase test. Enumeration of bacteria present in soil and water.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1	History of microbiology : Theory of spontaneous generation, role of microbes in fermentation, germ theory of disease, protection against infections	2
2	Applied areas of microbiology	1
3	Metabolism in bacteria: ATP generation	1
4	Chemoautotrophy, photoautotrophy, respiration, fermentation	3
5	Bacteriophages : structure and properties - Lytic and lysogenic cycles	2
6	Viroids, prions	1

7	Bacterial genetics: Genetic recombination, transformation, conjugation and transduction	3
8	Genetic engineering, plasmids, episomes, genetically modified organisms	2
9	Soil microbiology : microbial groups in soil	1
10	Microbial transformations of carbon, nitrogen, phosphorus and sulphur	3
11	Biological nitrogen fixation: symbiotic and non symbiotic nitrogen fixation	2
12	Plant microbe interaction. Rhizosphere and phyllosphere microflora	2
13	Beneficial microorganism in agriculture : biofertilizers – *Rhizobium*, mycorrhiza, *Azolla*	2
14	Microbial insecticides	1
15	Microbial agents for control of plant diseases	1
16	Microbes in composting	1
17	Microbiology of water : marine water, fresh water, potable water	1
18	Food microbiology : microbial spoilage and food preservation	1
19	Biodegradation of pesticides	1
20	Biogas production	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1	Acquaintance with equipments, glasswares etc. in microbiology laboratory	1
2	Acquaintance with microscope	1
3	Disinfection and sterilization methods	1
4	Preparation of culture media for fungi	1
5	Preparation of culture media for bacteria	1
6	Isolation of microbes from infected plant parts	2
7	Isolation and purification of bacteria by streak plate method	1
8	Staining and slide preparation of fungi	2
9	Staining of bacteria- simple and differential staining	2
10	Staining of endospore	1
11	Determination of quality of milk sample by methylene blue reductase test	1
12	Enumeration of bacteria present in soil	1
13	Enumeration of bacteria present in water	1

References:

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

COMP 4111 Introduction to Computer Applications 2(1+1)

Theory:

Historical Evolution of Computers, Computer System Concepts, Capabilities and Limitations, Types of computer: Analog, Digital, Hybrid, General Purpose, Special Purpose, Micro, Mini, Mainframe, Super, Generations of Computers, Type of PCs- Desktop, Laptop, Palmtop etc. their Characteristics, Computer Security, Basic Components of Computer System CPU, Input/Output and Memory, their Functions and Characteristics. Memory-RAM, ROM, EPROM, PROM and other type of Memory, Keyboard, Mouse, Digitizing Tablets, Scanners, Digital Cameras, MICR, OCR, OMR, Bar Code Reader, Voice Recognition, Light Pen, Touch Screen, Input/Output Devices, Monitors-Analog, Digital and Characteristics-size, Resolution, Video Standard-VGA, SVGA, XGA etc. Printers-Dot Matrix, Inkjet, Laser, Line Printer, Plotter, Sound Card and Speakers, Various Storage Devices- Magnetic Tape, Magnetic Disk, Cartridge Tape, Hard Disk Device, Floppy Disk, Optical Disk-CD, VCD, CD-R, CD-RW, DVD, Zip Drive, MS-Windows: Introduction to MS-Windows, Concept of GUI, Desktop and its elements, Windows explorer, Control Panel, Accessories, Running Application under MS Windows, Advantages and Limitation of Windows, various Versions of windows Like (Win 95,98,Win ME,

2000 XP), Hardware requirement for Windows XP, Basic concept of MS Word Processor, MS Excel, MS Power Point, Features of word processing packages, MS Excel packages, Power Point Package. Internet: world Wide Web (WWW), Concept, Web Browsing and Electronic Mail, concept of Networking.

Practical:

Study of Computer Components; Booting of Computer and its Shut Down; Practicing WINDOWS Operating System, Use of Mouse and Keyboard, Title Bar, Start Menu, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars; Setting time and date, Starting and Shutting down of Window, WINDOWS Explorer, Creating File and Folders, COPY and PASTE functions, MS-Word: Introduction to MS Word. Creating a Document, Saving and Editing, Word Proofing Tools-Using Spelling Checker, Working with Grammar Checker, Using Thesaurus, Working with Auto Text Feature in Word, Using Auto Correct Feature, Word Count. Text Formatting, Document Formatting (Page Formatting), Alignment of text, Creating Tables, Merging of Cells, Column and Row width and Chart in Word, Working with Mail Merge, Graphics and Web Pages in word, MS-Power Point**:** Introduction to MS Power Point. Power Point Slide Creation, Slide Show, Editing, Animation, Adding a Picture, Adding Graphics, Formatting, Customizing, Printing and Other inbuilt Additional Function. **MS Excel:** Introduction to MS Excel. Creating a Spreadsheet, Editing and saving. Working with Toolbars, Formatting, Formulas, Data Management, Graphs & Chart, Macros, Goal Seek Pivot Table, Financial Functions and Other inbuilt Additional Function. Data Analysis using inbuilt Tool Packs, Correlation & Regression. Internet Browsing: Browsing a Web Page and Creating of E-Mail ID.

Lecture schedule: Theory

S. No.	Topics	No.of lectures
1.	Historical Evolution of Computer, Computer System Concepts, Capabilities and Limitations	1
2.	Types of computer: Analog, Digital, Hybrid, General purpose, Special Purpose, Micro, Mini, Mainframe, Super, Generations of Computer, Type of PCs- Desktop, Laptop, Palmtop etc. their characteristics	2
3.	Computer Security, Basic Components of Computer System CPU, Input/output and Memory, their Functions and Characteristics. Memory-RAM, ROM, EPROM, PROM and other type of Memory	1
4.	Keyboard, Mouse, Digitizing Tablets, Scanners, Digital Cameras, MICR, OCR, OMR, Bar code Reader, Voice Recognition, Light Pen, Touch Screen, Input/output Devices	2
5.	Monitors-Analog, digital and Characteristics-size, Resolution, Video Standard- VGA, SVGA, XGA etc.	2
6.	Printers-Dot Matrix, Inkjet, Laser Line Printer, Plotter, Sound Card and Speakers	2
7.	Various Storage Devices- Magnetic Tape, Magnetic Disk, Cartridge Tape, Hard Disk Device, Floppy Disk-CD, VCD, CD-R, CD-RW, DVD, Zip Drive	2
8.	MS-Windows: Introduction to MS-Windows, Concept of GUI, Desktop and its elements, Windows explorer, Control Panel, Accessories, Running Application under MS Windows, Advantages and limitation Of Windows, various Versions of windows Like (win 95,98,Win ME,2000 XP), Hardware requirement for Windows XP	2
9.	Basic concept of MS Word Processor, MS Excel, MS Power point, Features of word processing Packages, MS Excel packages, Power Point Package. Internet: World Wide Web (WWW), Concept, Web Browsing and Electronic Mail, Concept of Networking	2

Lecture schedule: Practical

S. No.	Topics	No. of lectures
1.	Study of Computer Components; Booting of Computer and its Shut Down; Practicing WINDOWS Operating System, Use of Mouse and Keyboard, Title bar, Start menu, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars; Setting time and date, Starting and Shutting down of Window, WINDOWS Explorer, Creating File and Folders, COPY and PASTE Functions	2
2.	Introduction to MS Word. Creating a Document, Saving and Editing, word Proofing Tools-Using Spelling Checker, Working with Grammar Checker,	2
3.	Using Thesaurus, Working with Auto Text Feature in Word Using Auto Correct Feature, Word Count. Text Formatting, Document Formatting (Page Formatting), Alignment of text,	2
4.	Creating Tables, Merging of Cells, Column and Row width and Chart in Word, Working with Mail Merge, Graphics and Web pages in word	2
5.	Introduction to Power Point. Power point Slide Creation, Slide Show, Editing, Animation	2

	Adding a Picture, Adding Graphics, Formatting, Customizing, Printing and Other inbuilt Additional Function	
6.	Introduction to MS Excel. Creating a Spreadsheet, Editing and saving. Working with Toolbars, Formatting, Formulas, Data Management, Graphs &	2
7.	Chart, Macros, Goal Seek Pivot Table, Financial functions and other inbuilt Additional Function. Data Analysis using inbuilt Tool Packs, Correlation & Regression	2
8.	Internet Browsing: Browsing a Web Page and Creating of E-Mail ID.	2

References:

1. Sinha, P.K. Computer Fundamentals (BPB Publications).
2 Niranjan Mansal and Jayshri Saraogi Computer Made Easy For Beginners (Hindi)
3 Satish Jain, Shashank Jain and Madhullika Jain. It Tools and Applications (BPB Publications)
4 MS Office 2000. Joe Habraken
5 Rapidex Computer Course (Pustak Mahal)
6 Davinder Singh Minhas- Dynamic Memory Computer Course (Fusin Books), New Delhi.

MATHS 4111 Elementary Mathematics 2(2+0)

Functions and limits, continuity, differentiation of various types of functions; sum, product and quotient of functions, function of functions, parametric equations, successive differentiation, equations of tangent and normal, maxima and minima, methods of integration including integration by parts, definite integrals, application of definite integrals in finding areas under curves. Determinants, matrices, matrix addition and matrix multiplication, transpose of matrix, solution of linear equations using crammer's rule.

Lecture schedule: Theory

S. No.	Topic	No. of lectures
1.	Functions, Evaluation of Functions, Operations with functions	2
2.	Limits, continuity, $\lim_{x \to a} \frac{x^n - a^n}{x - a}$	2
3.	Limits $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$	2
4.	Differentiation Formulas for various types of functions, differentiation of sum and product of functions	2
5.	Quotient Rule, function of functions	2
6.	Differentiation of function of functions, Parametric Equation	2
7.	Equations of Tangent and Normal	2
8.	Successive differentiation	1
9.	Maxima and minima	2
10.	Integration Formulae	1
11.	Integration by Substitution	2
12.	Integration by Parts	2
13	Definite Integration	1
14	Area under curves	2
15	Matrices, Matrix Addition, equality of matrices, square matrix, identity, null matrix	2
16	Subtraction, Scalar Multiplication, Matrix Multiplication, Transpose of a Matrix	2
17	Determinants 2*2, 3*3	1
18	Symmetric, skew-symmetric matrix, Cramer's rule for solving system of linear equations,	2

References:

1. Krishi Ganita by Gokhroo and Jain.
2. Differential calculus by Dr. D.C. Gokhroo
3. Integral calculus by Dr. D.C. Gokhroo

ENG 4111 Comprehensive and Communication Skills in English 3

Theory:

Comprehension: Text for Comprehension: **Current English for Colleges**, by N.Krishnaswami & T. Sriraman (Macmillan India Limited, Madras, 1995), **Grammar & usage:** Tenses, Active/Passive Voice, Reported Speech, Prepositions, Phrasal Verbs, Concord, Determiners, **Vocabulary:** Synonyms, antonyms, homonyms, homophones, **Composition:** a) Letter and Application Writing: Personal/Business Correspondence, Preparation of Curriculum vitae and job applications. b) Précis writing.

Practical:

Phonetics (symbols) and transcriptions. Listening Comprehension: Listening to at least two tape recorded conversations aimed at testing and listening comprehension of students. Spoken English practice by using Audiovisual aids ,oral presentation of reports, one presentation by individual on the given topics related to Agriculture like WTO , developing new technology in Agriculture, , Bio fertilizers etc. Reading skills: using dictionary, rapid reading, intensive reading. Practice of Presentation by using Power Point and Data Projector .Group discussion and debates on current topics.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Text for Comprehension: **Current English for Colleges**, by N.Krishnaswami & T. Sriraman (Macmillan India Limited, Madras, 1995	10
2.	**Grammar & usage:** Tenses	2
3.	Active/Passive Voice	2
4.	Reported Speech, Prepositions,	2
5.	Phrasal Verbs,	1
6.	Concord	1
7.	Determiners	1
8.	**Vocabulary:** Synonyms	1
9.	antonyms,	2
10.	homonyms, homophones	2
11.	**Composition:** a) Letter and Application Writing:	2
12.	Personal/Business Correspondence,	2
13.	Preparation of Curriculum vitae and job applications. b)	2
14.	Précis writing	2

Lecture schedule: Practical

S. No.	Topic	No. of lectures
1.	Phonetics (symbols) and transcriptions.	2
2.	Listening Comprehension: Listening to at least two tape recorded conversations aimed at testing and listening comprehension of students	2
3.	Spoken English practice by using Audiovisual aids,	1
4.	Oral presentation of reports,	2
5.	One presentation by individual on the given topics related to Agriculture like WTO ,	2
6.	Developing new technology in Agriculture, like Bio fertilizers etc.	1
7.	Reading skills: using dictionary	1
8.	Rapid reading, intensive reading	1
9.	Practice of Presentation by using Power Point and Data Projector	2
10.	Group discussion and debates on current topics	2

References:

1. Thomson and Martinet (1995) "*A Practical English Grammar" OUP Publication*
2. Thomson and Martinet (1997) "*A Practical English Grammar, Exercise Books Vol. I & II" OUP Publication*
3. Michal Swan(1995) "*A Practical English Grammar" OUP Publication*
4. David Green (1990) "*Contemporary English Grammar Structure Composition*" McMillan.
5. A.S. Hornby (1997) "*Advance Learner's Dictionary" OUP Publication*
6. S. Allen (1997) "*Living English Structure"* Orient Longman
7. Daniel Jones (1997) "*Drills and Tests in English Sounds"* ELBS
8. Krishnamohan " *Speaking English Effectively*" McMillan
9. *Work Book of Indira Gandhi National Open University, Delhi.* (Course No. Feg.1,Feg.2 and Feg.3)
Audiovisual tapes prepared by British Council, New Delhi and CIEFL, Hyderabad.

NSNC 4221 NCC/NSS/ Physical Education

education of rural youth, eradication of social evils, awareness programmea, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition.

NCC: Introduction to NCC, defence services, system of NCC training, foot drill, sizing, forming up in three ranks, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, weapon training- rifle bayonet, light machine gun, sten machine carbine. Introductionand characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging distance, fire discipline and fire control orders, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self defence, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygine and sanitation, civil defence, leadership and NCC song.

Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises agility, strength, coordination, endurance and speed. Rules and regulations of important games, skill development in any one of the games- football,hockey, cricket, volleyball,, badminton, throw ball, tennis. Participation in one of the indoor games-badminton, chess and table tannis. Rules and regulations of athletic events, participation in any one of the athletic events- long jump, high jump, triple jump, javlin throw, discuss throw, shot put, short and long distance runnings. Safety education, movement education, effective way of doing day to day activities. First - aid training, coaching for major games and indoor games. Asans and indigenous way for physical fitness and curative exercises. Exercises and games for leisure time, use and experiences.

Note: *Warming up and conditioning exercises are compulsory before the commmencemewnt of each class.*

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

II Semester

AGRON 4121 Agricultural Meteorology 2(1+1)

Theory:

Atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Daily and seasonal variation of wind speed and direction, cyclones, anticyclones and air masses; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave and thermal radiation ,net radiation, albedo; Atmospheric temperature, daily and seasonal variations of temperature, heat balance of earth and global warming; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, snow, rain and hail; Precipitation, cloud formation and movement; Agriculture and weather relations; Introduction to monsoon; Use of weather data for irrigation scheduling, pesticide sprays, fertilizer application; Climatic normals for crop production, Basics of weather forecasting.

Practical:

Agro-meterological observatory – its site selection, installation and exposure of instruments, weather data recording; Measurement of total solar radiation, short wave and long wave radiation, albedo and sunshine duration; Maximum and minimum air temperature, soil temperature, dew point temperature; Determination of vapor pressure, relative humidity, atmospheric pressure, wind speed and wind direction; Measurement of rain, open pan evaporation and evapo-transpiration; Processing, tabulation and presentation of weather data.

Lecture schedule :Theory

S.No.	Topic	No. of lectures
1.	Atmosphere its composition, extent and structure.	1
2.	Introduction to atmospheric weather variables.	1
3.	Introduction to atmospheric pressure, its variation with height, cyclones and anticyclones	1
4.	Daily and seasonal variation of wind speed and direction and air masses	1
5.	Nature and properties of solar radiation, solar constant, depletion of solar radiation	1
6.	Short wave and thermal radiation, net radiation, albedo of soil and crops.	1
7.	Atmospheric temperature and global warming.	1

8.	Daily and seasonal variations of temperature, heat balance of earth.	1
9.	Atmospheric humidity, concept of saturation and vapor pressure	1
10.	Process of condensation, formation of dew, fog, mist.	1
11.	Formation of frost, snow and rain and hail	1
12.	Precipitation, cloud formation and movement.	1
13.	Agriculture and weather relations, use of weather data for irrigation scheduling, pesticide spray & fertilizer application.	1
14.	Monsoon – meaning, types and characteristics	1
15.	Climatic normals for crop production.	1
16.	Basics of weather forecasting	1

Lecturer schedule: Practical

S.No.	Topic	No. of Lectures
1.	Agro-meteorological observatory site selection, installation and exposure of instruments	1
2.	Handling of meteorological instruments and weather data recording	1
3.	Measurement of total solar radiation	1
4.	Measurement of long and short wave radiation	1
5.	Measurement of albedo and sunshine duration	1
6.	Measurement of maximum and minimum air temperature	1
7.	Measurement of soil temperatures	1
8.	Measurement of dew point temperature	1
9.	Determination of vapor pressure and calculation of relative humidity	1
10.	Measurement of atmospheric pressure	1
11.	Measurement of wind direction and speed	1
12.	Measurement of rainfall	1
13.	Measurement and determination of open-pan evaporation	1
14.	Processing of weather data	1
15.	Tabulation of weather data	1
16.	Presentation of weather data	1

References:

1. Sacheti,A.K. 1985. Agricultural Meteorological Instructional Cum Practical Manual (Ed.) NCERT Publication, New Delhi.
2. Mavi, H.S. 1994, Introduction to Agrometeorology, Oxford & IBH Publishing Co., New Delhi.
3. Lal, D.S. 2005 Climatology, Sharda Pustak Bhawan, Allahabad..
4. Barry ,R.G. and Chorley, R.C. 1985. Atmosphere Weather and Climate. English Language Book Soc. Publication.
5. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology. ICAR, New-Delhi.
6. Sahu, D.D., 2003. Agrometeorology and Remote sensing: Principles and Practices , Agrobios (India) , Jodhpur.
7. Murithy, K, and Radha, V. 1995. Practical Manual on Agricultural Meteorology , Kalyani Publishers, New-Delhi

PBG 4121 Principles of Plant Breeding 3(2+1)

Theory:

Introduction to ecological and taxonomical classification of plants. Historical development, nature and role of plant breeding. Modes of reproduction (Sexual, asexual and vegetative) and their relation with plant breeding. Fertility regulatory mechanisms (incompatibility, male sterility and apomixes),their classification and importance in plant breeding. Inheritance of qualitative and quantitative characters and heritability. Pure line theory and genetic basis of selection. Hardy- Weinberg law. Heterosis and theories of Heterosis and inbreeding depression. Germplasm resources and center of diversity. Domestication, introduction and acclimatization in relation to plant improvement. Improved genotypes of different crop plant- variety, Different breeding methods of their

development. Inbred line, different hybrids, synthetic, composite, multiline, clone, etc Polyploidy in relation to plant breeding. Mutation breeding –types, role and methods of mutation breeding. Use of biotechnology in plant breeding. Procedure for release of new variety.

Practical:

Identification of plants of different ecological groups. Floral biology of different crop plants. T.S. of ovary. Mounting of different types of ovules. Study of microsporogenesis and megasporogenesis. Study of pollen viability. Study of pollen size. Emasculation and hybridization techniques in important self and cross pollinated crops. Study of male sterility in sorghum/bajra. Calculation of mean, range, variance and standard deviation.

Lecture schedule: Theory

S. No.	Topic	No. of lectures
1	Introduction to ecological and taxonomical classification of plants.	2
2	Historical development, nature and role of plant breeding.	2
3	Modes of reproduction (Sexual, asexual and vegetative) and their relation with plant breeding.	3
4	Fertility regulatory mechanisms (incompatibility, male sterility and apomixes), their classification and importance in plant breeding.	3
5	Inheritance of qualitative and quantitative characters and heritability.	2
6	Pure line theory and genetic basis of selection.	1
7	Hardy- Weinberg law.	1
8	Heterosis and theories of Heterosis and inbreeding depression	2
9	Germplasm resources and center of diversity.	2
10	Domestication, introduction and acclimatization in relation to plant improvement.	2
11	Improved genotypes of different crop plant- variety,	2
12	Different breeding methods of their development. inbred line, different hybrids, synthetic, composite, multiline, clone, etc	3
13	Poly ploidy in relation to plant breeding.	2
14	Mutation breeding –types, role and methods of mutation breeding.	2
15	Use of biotechnology in plant breeding	2
16	Procedure for release of new varieties	1

Lecture Schedule: Practical

S. No.	Topic	No. of lectures
1	Identification of plants of different ecological groups.	2
2	Floral biology of different crop plants.	4
3	T.S. of ovary. Mounting of different types of ovules.	1
4	Study of microsporogenesis and megasporogenesis.	2
5	Study of pollen viability. Study of pollen size.	1
6	Emasculation and hybridization techniques in important self and cross pollinated crops.	4
7	Study of male sterility in sorghum/bajra.	1
8	Calculation of mean, range, variance and standard deviation.	1

References:

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. Kharackwal.2004. Plant Breeding- Mendelian to Molecular approach. Narosa Publishing House, New Delhi.

PPATH 4121 Plant Pathogens and Principles of Plant Pathology 4 (3+1)

Theory:

Introduction, Important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viriods, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Prokaryotes: classification of prokaryotes according to Bergey's Manual

of Systematic Bacteriology. General Characters of fungi, Definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction in fungi (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to kingdoms and phylum, Introduction: Definition and objectives of Plant Pathology. History of Plant Pathology. Terms and concepts in Plant Pathology. Phenomenon of infection - pre-penetration, penetration and post penetration. Pathogenesis – Role of enzymes, toxins, growth regulators and polysaccharides. Defense mechanism in plants – structural and biochemical. Plant disease epidemiology. Plant Disease Forcasting - Remote sensing - General principles of plant diseases management - Importance, general Principles - Avoidance, exclusion, protection - Plant Quarantine and Inspection -Quarantine Rules and Regulations. Cultural methods - Rougeing, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage. Role and mechanisms of biological control and PGPR classification of fungicides and their uses. Host plant resistance – Application of biotechnology in plant disease management -Development of disease resistant transgenic plants through gene cloning. Integrated plant disease management (IDM) - Concept, advantages and importance.

Practical:

Acquaintance to plant pathology laboratory and equipments; Preparation of culture media for *fungi* and *bacteria;* Isolation techniques, preservation of disease samples; Study of *Pythium, Phytophthora* and *Albugo;* Study of *Sclerospora, Peronosclerospora, Pseudoperonospora, Peronospora, Plasmopara* and *Bremia;* Study of genera *Mucor* and *Rhizopus.* Study of *Oidium, Oidiopsis, Ovulariopsis, Erysiphe, Phyllactinia, Uncinula and Podosphaera;* Study of *Puccinia* (different stages), *Uromyces, Hemiliea;* Study of *Sphacelotheca, Ustilago and Tolyposporium;* Study of *Agaricus, Pleurotus and Ganoderma;* Study of *Septoria, Colletotrichum, Pestalotiopsis and Pyricularia;* Study of *Aspergillus, Penicillium, Trichoderma, and Fusarium;* Study of *Helminthosporium, Drechslera, Alternaria, Stemphyllium, Cercospora, Phaeoisariopsis, Rhizoctonia and Sclerotium;* Demonstration of Koch's postulates. Preparation of fungicides – Bordeaux mixture, Bordeaux paste. Chestnut compounds; Methods of application of fungicides – seed, soil and foliar. Visit of quarantine station and remote sensing laboratory.

Lecture schedule: Theory

S.No.	Topics	No. of lectures
1.	Definition and objectives of plant pathology, history of plant pathology	1
2.	Terms and concepts in plant pathology	6
3.	Important Plant Pathogenic Organisms: fungi, bacteria, phytoplasma, spiroplasma, viruses, viroids, algae, protozoa and Phanerogamic parasites with examples of diseases caused by them.	2
4.	Prokaryotes: classification of prokaryotes according to Bergey's manual of systematic bacteriology.	6
5.	Definition of fungus, general characters of fungi, somatic structures, types of fungal thalli, reproduction in fungi (asexual & sexual).	2
6.	Nomenclature and classification of fungi, key to divisions and sub-divisions. Survival and dispersal of plant pathogens	1
7.	Phenomenon of infection, pre-penetration, penetration and post penetration	2
8.	Pathogenesis : Role of enzymes, toxins, growth regulators and polysaccharides	4
9.	Defense mechanism in plants – structural & bio-chemical (Pre and post infection)	2
10.	Plant disease epidemiology. Plant disease forecasting, remote sensing-General principles of plant disease management: importance, avoidance, exclusion, protection, plant quarantine and inspection, quarantine rules and regulations	4
11.	Cultural methods – rouging, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather, ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage	2
12.	Role and mechanisms of biological control and PGPR	5
13.	Physical methods– heat & chemical methods- methods of application of fungicides.	2
14.	Host plant resistance. Application of biotechnology in plant disease management.	2
15.	Development of disease resistance transgenic plants through gene cloning	4
16.	Integrated plant disease management :concepts, advantages and importance	3

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Acquaintance to plant pathology laboratory and equipments	1
2.	Preparation of culture media for *fungi* and *bacteria*	2
3.	Isolation techniques	1
4.	Preservation of disease samples	1
5.	Study of *Pythium, Phytophthora, Plasmopara* and *Bremia*	1
6.	Study of genera *Mucor* and *Rhizopus.*	1
7.	Study of *Oidium, Oidiopsis, Erysiphe, Phyllactinia, Uncinula and Podosphaera*	2
8.	Study of *Puccinia, Uromyces, Hemiliea, Sphacelotheca, Ustilago and Tolyposporium*	2
9.	Study of *Agaricus, Pleurotus and Ganoderma*	1
10.	Study of *Septoria, Colletotrichum, Pyricularia, Pestalotiopsis, Helminthosporium, Alternaria, Stemphyllium, Cercospora, Phaeoisariopsis, Rhizoctonia and Sclerotium*	1
11.	Proven of Koch's postulates	1
12.	Preparation of Bordeaux mixture, Bordeaux paste. Chestnut compounds	1
	Visit of quarantine station and remote sensing laboratory.	1

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1. Agrios, G.N. 1996. Plant Pathology, Academic Press, New Delhi.
2. Alexopolus, C.J., Mims, C.W. and Blackwell, M. 1996. Introductory Mycology, John Wiley Estern Private Limited, New York.
3. Mehrotra, R.S. and Aggarawal, A. 2007. Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Singh, R.S. 1996. An Introduction to Principles of Plant Pathology. Oxford & IBH, New Delhi.
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ENTO 4121 Insect Morphology and Systematics 3 (2+1)

Theory:

History of Entomology in India. Factors for insect dominance. Classification of phylum Arthropoda upto classes. **Morphology:** Structure and functions of insect cuticle and moulting. Body segmentation; structure of head, thorax and abdomen of grasshopper. Structure and modifications of insect antennae, mouth parts and legs. Wing venation, modifications and wing coupling apparatus. Sensory organs. Metamorphosis in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (endocrine) and reproductive systems in grasshopper. Types of reproduction in insects. **Systematics:** Taxonomy -importance, history and binomial nomenclature. Definitions of species, sub-species sibling species and biotype, Classification of class Insecta up to families:

Orthoptera- Acrididae

Isoptera- Termitidae

Thysanoptera- Thripidae

Hemiptera-Pentatomidae,Coreidae,Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae

Lepidoptera- Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae

Coleoptera- Coccinellidae, Galerucidae, Cerambycidae, Curculionidae, Bruchidae, Melonthidae

Hymenoptera-Tenthridinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae

Diptera- Cecidomyiidae, Trypetidae, Tachinidae, Agromyzidae.

Dictyoptera- Mantidae, Blattidae

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; Dissection of digestive and nervous system in insects; Study of characters of orders Orthoptera, Dictyoptera, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

Lecture Schedule: Theory

S.No.	Topic	No. of lectures
1.	History of Entomology in India.	1
2.	Factors for insect dominance.	1
3.	Classification of phylum Arthropoda upto classes.	1
4.	Structure and functions of insect cuticle and moulting.	2
5.	Body segmentation; structure of head, thorax and abdomen of grasshopper	2
6.	Structure and modifications of insect antennae	1
7.	Structure and modifications of insect mouth parts	2
8.	Structure and modifications of insect legs	1
9.	Wing venation, modifications and wing coupling apparatus.	2
10.	Sensory organs	1
11.	Metamorphosis in insects	1
12.	Types of larvae and pupae	1
13.	Structure and functions of digestive system in insects.	1
14.	Structure and functions of circulatory system in insects.	1
15.	Structure and functions of excretory system in insects.	1
16.	Structure and functions of respiratory system in insects.	1
17.	Structure and functions of nervous system in insects.	1
18.	Structure and functions of secretory (endocrine) system in insects.	1
19.	Structure and functions of reproductive system in insects.	1
20.	Types of reproduction in insects	1
21.	Taxonomy -importance, history and binomial nomenclature	1
22.	Definition of species, sub-species sibling species and biotype	1
Classification of class Insecta up to families		
23.	Orthoptera-Acrididae; Isoptera-Termitidae; Thysanoptera-Thripidae	1
24.	Hemiptera-Pentatomidae,Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae	1
25.	Lepidoptera- Noctuidae,Sphingidae,Pyralidae,Gelechiidae, Arctiidae	1
26.	Coleoptera- Coccinellidae, Galerucidae, Cerambycidae, Curculionidae, Bruchidae, Melonthidae	1
27.	Hymenoptera-Tenthridinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae	1
28.	Diptera- Cecidomyiidae, Trypetidae, Tachinidae, Agromyzidae; Dictyoptera-Mantidae, Blattidae	1

Lecture Schedule: Practical

S.No.	Topic	No. of lectures
1.	Methods of collection and preservation of insects including immature stages	1
2.	External features of Grasshopper/ Cockroach	1
3	Insect antennae and their modifications	1
4.	Insect mouthparts and their modifications	1
5.	Dissection of insect mouthparts	1
6.	Insect legs and their modifications	1
7	Wing venation, types of wings and wing coupling apparatus	1
8	Dissection of digestive system in insects	1
9	Dissection of nervous systems in insects	1
10	Study of characters of orders Orthoptera and Dictyoptera and their families	1
11	Study of characters of orders Isoptera, Thysanoptera and their families	1
12	Study of characters of order Hemiptera and its families	1
13	Study of characters of order Lepidoptera and its families	1
14	Study of characters of order Coleoptera and its families	1
15	Study of characters of order Hymenoptera and its families	1
16	Study of characters of order Diptera and its families	1

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1. Nayar. K.K, Ananthakrishnan .T.N. and David. B.V. 1976. General and Applied Entomology. Mc graw Hill publishing Co. Ltd. New Delhi.

2. Richards O.W. and Davies R.G. 1977. Imm's General Text Book of Entomology, Vol. I & II. Chapman and Hall, London.
3. Pant. N.C. and Ghai, S. 1981. Insect Physiology and Anatomy, ICAR, New Delhi.
4. Chapman .R.F.1974. Insect Structure and Function, ELBS Publishers New Delhi.
5. Snodgrass.R.E .2001. Principles of Insect Morphology.
6. Mathur and Upadhyay, 2000. A Text Book of Entomology, Aman Publishing House, Meerut.

AGECON 4121 Principles of Agricultural Economics 2 (2+0)

Theory:

Meaning, definition, subject matter, Division and Importance of economics. Meaning, definition of Agricultural Economics. Basic concepts of goods, service, utility, value, price, wealth & welfare economics. Meaning, characteristics, importance and classification of wants. Theory of consumption. Law of diminishing marginal utility – meaning & importance. Demand - meaning, definition and kinds of demands, Demand schedule and demand curve. Law of demand - extension and contraction Vs increase and decrease in demand. Elasticity of demand – meaning and definition, types of elasticity of demand, degree of price elasticity of demand, Method of measuring elasticity – factors influencing elasticity of demand and importance of elasticity of demand. Laws of supply – meaning & definition, supply schedule, supply curve, elasticity of supply and factor influencing in elasticity of supply. National income–concepts & measurement. Meaning and classification of taxes and cannons of taxation. Inflation- meaning, definition, kinds of inflation .

Lecture schedule -Theory

S.No.	Topic	No. of lectures
1.	Economics – Meaning, definition, subject matter	1
2.	Division of economics, Importance of economics	2
3.	Agricultural Economics, meaning, definition	1
4.	Basic concepts of goods, service, utility, value, price, wealth, welfare	2
5.	Wants – meaning, characteristics, importance and classification of wants	2
6.	Theory of consumption	2
7.	Law of diminishing marginal utility, meaning, importance	2
8.	Demand meaning, definition, kinds of demands	2
9.	Demand schedule, demand curve	1
10.	Law of demand, extension and contraction Vs increase and decrease in demand	2
11.	Elasticity of demand, types of elasticity of demand, degree of price elasticity of demand	2
12.	Method of measuring elasticity – factors influencing elasticity of demand, importance of elasticity of demand	2
13.	Laws of supply, supply schedule, supply curve, elasticity of supply, factor influencing elasticity supply	3
14.	National income – concepts, measurement	3
15.	Meaning and classification of taxes, cannons of taxation	3
16.	Inflation- meaning, definition, kinds of inflation	2

References:

1. K.K. Dewett and J.D. Verma (1986) Elementary Economic Theory, S.Chand & Company, New Delhi
2. P.A. Samuelson & W.D. Nordhaus (1987) Economics, McGraw-Hill, Singapore
3. S.K. Mishra and V.K. Puri (1996) Indian Economy, Himalaya Publishing House, New Delhi
4. G.B. Jathar and S.G. Beri (1996) Elementary Principles of Economics, Oxford University Press (10th Edition), Delhi
5. Berkeley Hill (1980) An Introduction to Economics for students of agriculture, Pergaman Press, Oxford

AENGG 4121 Fundamentals of Soil and Water Conservation Engineering 2(1+1)

Theory:

Classification of irrigation projects and components of canal system; Ground water sources- types of aquifers; Centrifugal pumps; Measurement of irrigation water; Water conveyance system; Pressurized irrigation methods- sprinkler and drip; Soil erosion- types and factors affecting soil erosion; Brief description about erosion control

structures for agricultural lands; for non-agricultural, denuded and wastelands; Temporary gully control structures.

Practical:

Power calculation for pumps; Field measurement of irrigation water; Design of open channels; Determination of fertilizers doses, uniformity coefficient and capacity of a sprinkler irrigation system; Visit to farmers adopting sprinkler and drip irrigation systems; Visit to watershed areas.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Classification of irrigation projects- major, medium and minor irrigation projects; Related terminology - Gross command area, Culturable Command Area, Intensity of irrigation, Delta, Base, Duty, Irrigation potential	1
2.	Components of canal irrigation system- reservoir, barrage, head works, ridge canal, contour canal, main canal, branch canal, major distributary, minor distributary, canal outlets, water course, field channel.	1
3.	Ground water sources- Lithosphere, zone of saturation, zone of aeration; types of aquifers-unconfined, confined, semi-confined and perched aquifers.	1
4.	Centrifuged pumps- volute and diffuser types; Principle of operation of centrifugal pumps; Performance characteristic curves.	1
5.	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
6.	Measurement of irrigation water- volume method, velocity- area methods, water meter, weirs- rectangular, cipolletti, 90° v- notch; standard conditions for installing a weir; Parshall flume and cutthroat flume.	2
7.	Water conveyance system- open channels; Definition of wetted perimeter, hydraulic radius, hydraulic slope, free board, angle of repose.	1
8.	Estimation of velocity of flow in open channels by Manning's equation and design of open channel.	1
9.	Sprinkler irrigation method- adoptability, limitations, types, components and layout, fertilizer application, moisture distribution pattern and uniformity of coverage, evaluation of sprinkler irrigation system.	2
10.	Drip irrigation method- Adoptability, limitation, components and layout.	1
11.	Soil erosion, types of soil erosion- rain drop, sheet, rill, and gully erosion; factors affecting soil erosion.	1
12.	Brief description about contour bunds, graded bunds, bench terraces; Contour trench, staggered trench, box cum pit; Grassed waterways.	1
13.	Brief description about temporary gully control structures.	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Numerical problems on friction head, velocity head, total head and horse power calculation of pumps.	2
2.	Measurement of irrigation water in the field by different methods and related numerical.	2
3.	Numerical on design of open channels.	2
4.	Numerical on estimation of fertilizer doses and capacity of a sprinkler irrigation system.	1
5.	Determination of uniformity coefficient of a sprinkler irrigation system.	1
6.	Visit to farmers using sprinkler and drip irrigation systems- their experiences, problems and remedies.	2
7.	Visit to nearby canal irrigation system.	3
8.	Visit to nearby watersheds.	3

Suggested Readings:

1. Land and Water Management Engineering. 1982. Murthy V.V.N. Kalyani Pubhliers, New Delhi.
2. Irrigation: Theory and Practices.1989. Michael A.M. Vikas Publishing House Pvt. Ltd., New Delhi.

3. Principles of Agricultural. Engineering. Vol. II. 1993. Michael A.M. and T.P. Ojha. Jain Brothers, New Delhi.

BIOCH 4121 **Biochemistry** **3 (2+1)**

Theory:

Biochemistry – Introduction and importance. Plant cell, cell wall and its role in livestock, food and paper industries. Structure, properties & applications of biomolecules: amino acids, peptides and proteins. Plant proteins and their quality. Enzymes – classification, factors affecting the activity, immobilization and other industrial applications. Lipids – classification, properties and their industrial application in soaps, paints, lubricants, plastics including biodegradable plastics, bio-diesel etc. Carbohydrates – classification, structure and functions. Nucleotides and nucleic acids. Metabolism – basic concepts, glycolysis, citric acid cycle, pentose phosphate pathway, oxidative phosphorylation and fatty acid oxidation. General reactions of amino acids. Biosynthesis – carbohydrates, lipids, proteins and nucleic acids. Metabolic regulation. Secondary metabolites - terpenoids, alkaloids, phenolics and their applications in food and pharmaceutical industries.

Practical:

Preparation of standard solutions and buffers. Determination of pH. Qualitative tests for carbohydrates, lipid, amino acids and proteins. Identification of plant pigments by paper chromatography. Thin layer chromatography of lipids. Assay of enzyme and effect of pH. Demonstration of column chromatography. Extraction of oil from oil seeds. Quantitative determination of carbohydrates (sugars), proteins and phenols. Extraction of nucleic acids.

Lecture Schedule : Theory

S. No.	Topic	No.of lectures
1.	Biochemistry – introduction and importance	1
2.	Plant cell and cell wall-structure and functions	1
3.	Role of plant cell in livestock, food and paper industries.	1
4.	Structure, properties and application of amino acids and peptides	1
5.	General reactions of amino acids	1
6.	Structure of proteins - primary, secondary, tertiary and quaternary	1
7.	Classification of proteins and quality of plant proteins	1
8.	Enzyme classification and factors affecting enzyme action	1
9.	Cofactor, coenzyme and enzyme inhibitions	1
10.	Mechanism of enzyme action	1
11.	Enzyme immobilization and other industrial applications	1
12.	Carbohydrate-classification and stereoisomerism	1
13.	Structure and functions of carbohydrates	1
14.	Chemical properties of carbohydrates.	1
15.	Structure, properties and classification of lipids and fatty acids	1
16.	Structure and function of triglycerides, phospholipids and sphingolipids	1
17.	Industrial application of lipids in soaps, paints, lubricants, plastics including biodegradable plastics, bio-diesel etc.	1
18	Nucleosides, nucleotides and structure of DNA	1
19	Structure, types and functions of RNA	1
20	Basic concept of metabolism and glycolysis,	1
21	Citric acid cycle and pentose phosphate pathway	1
22	Fatty acid oxidation and oxidative phosphorylation	1
23	Photosynthesis –light and dark reactions	1
24	Biosynthesis of sucrose, starch	1
25	Biosynthesis of fatty acids and acylglycerols	1
26	Elementary concept of protein synthesis	1
27	Elementary concept of DNA replication	1
28	Metabolic regulation	1
29	Secondary metabolites–types and their applications in food and pharmaceutical industries.	1
30	Structure and function of terpenoids	1
31	Structure and function of alkaloids.	1
32	Structure and function of phenolics	1

Lecture Schedule: Practical

S. N.	Topic	No.of lectures
1.	Preparation of standard solutions and buffer solutions.	1
2.	Determination of pH.	1
3.	Qualitative test of carbohydrates	1
4.	Qualitative test for lipids	1
5.	Qualitative test for amino acids and proteins	1
6.	Quantitative estimation of sugars	1
7.	Quantitative estimation of amino acids	1
8.	Quantitative estimation of proteins.	1
9.	Estimation of phenols	1
10.	Identification of plant pigments by paper chromatography.	1
11.	Thin layer chromatography of lipids	1
12.	Demonstration of column chromatography	1
13.	Assay of enzyme	1
14.	Effect of ph on enzyme activity	1
15.	Extraction of oil from oil seeds	1
16.	Extraction of nucleic acids	1

References:

1. Lehninger AL (2004). Principles of Biochemistry, Freeman and Company, USA
2. Conn EE, Stumpf PK, Bruining G and Doi RH (2007). Outlines of Biochemistry. John Wiley and Sons, New York
3. Nelson DL and Cox MM (2000). Lehninger Principles of Biochemistry 3rd edn, Printed in India by Replica Press Pvt. Ltd., New Delhi for Worth Publishers, New York.
4. Goodwin, TW and Mercer EI (1998). Introduction to Plant Biochemistry, Progamon Press Inc. Deffered UK
5. De Robertis EDP and De Robertis EMF (2006). Cell and Molecular Biology, B I Publications Pvt Ltd, New Delhi
6. Sahney SK and Singh RR (2002). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi
7. Yadav VK and Yadav N (2007). Biochemistry and Biotechnology-A Laboratory Manual, Pointer Publishers, Jaipur

SCHEM 4121 Soil Chemistry, Soil Fertility and Nutrient Management 2(1+1)

Theory:

Essential and beneficial elements, criteria of essentiality, forms of nutrients in soil, mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities, nutrient availability to plants in Acid, salt affected and calcarious soils: Concept of soil fertility, different approaches/methods for soil fertility evaluation -- Biological method. Plant analysis method: DRIS methods, critical levels in plants. Rapid tissue tests. Indicator plants. Soil analysis methods: critical levels of different nutrients in soil. Soil test based fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Integrated nutrient management.

Practical:

Analytical chemistry – Basic concepts, techniques and calculations, Principles of analytical instruments and their calibration and applications, Estimation of available N, P, K, S, Zn and Fe in soil, Estimation of N, P and K in plants.

Lecture schedule: Theory

S. No.	Topic	No. of lectures
1.	Essential and beneficial elements, essentiality criteria , forms of nutrients in soil	1
2.	Role of essential nutrient in plant growth	1
3.	Deficiency and toxicity symptoms of nutrients in plant	1
4.	Measures to overcome deficiencies and toxicities of essential nutrients in plant	1
5.	Mechanisms of nutrient uptake and transport from soil to plant	2
6.	Factors affecting nutrient availability to plants	1
7.	Nutrient availability in acid, salt affected and calcarious soils	1
8.	Soil fertility concept : Law of minimum, law of diminishing return, Baule units, Bray's nutrient mobility concept.	1

9.	Soil fertility evaluation : Biological methods, use of visual symptoms of nutrient deficiency or toxicity	1
10.	Soil fertility evaluation : Plant analysis method – DRIS methods, critical levels in plants, rapid tissue tests, indicator plants	1
11.	Soil fertility evaluation: Soil analysis methods – critical levels of different nutrients in soil.	1
12.	Interpretation and calibration of soil test values and fertilizer recommendations to crops	1
13.	Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers.	2
14.	Integrated nutrient management (concept, components and importance)	1

Lecture schedule: Practical

S. No.	Topic	No. of lecture
1.	Analytical chemistry – Basic concepts, techniques and calculations	2
2.	Principle of analytical instruments and their calibration for soil and plant analysis	2
3.	Determination of available nitrogen in soil	1
4.	Determinationof available phosporus in soil	2
5.	Determination of available potassium in soil	1
6.	Determination of available sulphur in soil	1
7.	Determination of available zinc in soil	1
8.	Determination of available iron in soil	1
9.	Rapid plant tissue test	1
10.	Estimation of N,P,and K in plant	4

References:

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)

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

AGRON 4211 Field Crops-I (*Kharif*) 3(2+1)

Theory

Origin, geographic distribution, importance, soil and climatic requirement**,** varieties; cultural practices *viz.* seed and sowing , intercultural operations, fertilizer, water and weed management, plant protection ; harvesting and yield of – rice, maize, sorghum, (grain and forage), pearl millet(grain and forage); pigeonpea, groundnut.soybean and cotton ; Package of practices of mungbean ,urdbean, cowpea, mothbean, clusterbean, sunhemp, castor, sesame, minor millets and napier .Acquaintance about *Panicum, Lasiura*s and *Cenchrus.*

Practical:

Rice nursery preparation ,seed bed preparation and sowing of *kharif* crops; Calculations on seed rate; Sowing of mungbean, pearl millet, and cotton; Effect of seed size on germination and seedling vigour ; Identification of weeds in pearl millet and other crops ; Fertilizer application and top dressing of nitrogen in pearl millet and study on fertilizer experiments ; Study of yield contributing characters, yield calculations, harvesting and yield estimation ; Study of crop varieties and important agronomic experiments.

Lecture schedule :Theory

S.No.	Topic	No. of lectures
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

Lecturer schedule: Practical

S.No.	Topic	No. of lectures
1.	Identification of seeds, crops and other inputs	1
2.	Sowing methods of different *kharif* crops	1
3.	Seed bed preparation of *kharif* crops	1

4.	Working out seed rate, real value and 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	1
8.	Identification of weeds in pearl millet and other crops	1
9.	Acquaintance with plant protection measures in different 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.	Crop harvesting and yield estimation	1
16.	Visit of experiments at farm	1

References:

Singh, Chhidda; Singh P. and Singh, R. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
Singh, S.S. 1998, Crop Management: Under irrigated and rainfed conditions.
Singh, S.S. 1993, Principles and Practices of Agronomy, Kalyani Publishers, New Delhi.
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AGRON 4212 Weed Management 2(1+1)

Theory:

Weeds- introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy; Concepts of weed prevention, control and eradication; Methods of weed control- physical, cultural, chemical and biological methods; Integrated weed management; Herbicides- advantages and limitation of herbicide usage in India; Herbicide classification, formulations, methods of application; Introduction to Adjuvants and their use in herbicides; Introduction to selectivity of herbicides; Compatibility of herbicides with other agro chemicals; Weed management in major field crops. Aquatic weeds and their management.

Practical:

Identification of weeds; Preparation of herbarium of weeds; Study of crop weed competition ; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, *Parthenium* and *Celosia;* Economics of weed control practices; visits of problem areas (field).

Lecture schedule :Theory

S.No.	Topic	No. of lectures
1.	Weeds – definition , harmful and beneficial effects and classification	1
2.	Ecology of weeds	1
3.	Weed - reproduction and seed dissemination	1
4.	Crop-weed competition-concept and allelopathy	1
5.	Concepts of weed prevention, eradication and weed control	1
6.	Physical and cultural methods of weed control	1

7.	Chemical and biological methods of weed control	1
8.	Integrated weed management - An introduction	1
9.	Introduction to herbicides, advantages and limitations of herbicides usages	1
10.	Classification of herbicides	1
11.	Introduction of adjuvants-surfactants, stabilizing agents and solvents	1
12.	Adjuvants - stickers, activators and compatibility agents	1
13.	Interaction of herbicides with other agro chemicals	1
14.	Weed management in rice, wheat, barley, maize, sorghum and bajra	1
15.	Weed management in oil seeds & pulses – groundnut , soybean, mustard, gram , lentil,,mungbean and urdbean	1
16.	Aquatic weeds and their management	1

Lecturer schedule: Practical

S.No.	Topic	No. of lectures
1.	Identification of common weeds and their characteristics	1
2.	Biology of nut sedge and bermuda grass	1
3.	Biology of *Parthenium* and *Celosia*	1
4.	Collection of common *kharif* weeds and their preservation	1
5.	Collection of common *rabi* seeds and their preservation	1
6.	Collection of perennial weeds and their preservation	1
7.	To study crop weed competition	1
8.	Identification of common herbicide with their trade name and uses	1
9.	To become familiar with herbicide spray equipments	1
10.	Calibration of herbicide spray equipments	1
11.	Calculation on herbicideal requirement for field crops and aquatic situation	1
12.	Application of pre plant , pre-emergence and post emergence herbicides in the field	1
13.	Application of herbicides under aquatic situation	1
14.	Study of phytotoxicity symptoms of herbicides in different crops	1
15.	Economics of weed control practices	1
16.	Visit to problem areas (field) of weeds	1

References:

1. Gupta , O.P. 2005. Weed Management: Principles and Practices (2nd Ed) Agribios (India) Jodhpur.
2. Gupta, O.P. 2002 . Modern Weed Management , Agribios (India) Jodhpur.
3. Rao, V.S. 2000. Principles of Weed Science (2nd Ed) , Oxford & IBH Publishing Co., New-Delhi.
4. Saraswat, V.N., Bhan, V.M. and Yaduraju, N.T. 2003. Weed Management , ICAR, New- Delhi.

NEMAT 4211 Introductory Nematology 2(1+1)

Thoery:

History and economic importance of plant parasitic nematodes; Characters of Phylum Nematoda and systematic position of plant parasitic nematodes (outline classification upto Generic level); General morphology, ecology and biology; Plant nematode relationship; Kinds of parasitism and symptomology; Nematode interaction with other micro-organisms; Nematode diseases of crop plants of economic importance in State with special reference to *Meloidogyne* spp; *Heterodera avenae, Anguina tritici* and *Rotylenchulus reniformis* Tylenchulus *semipenetrans;* Principles of nematode management.

Practical:

Study of compound microscope alongwith other laboratory necessaries, Survey and Collection of soil and plant samples, extraction of nematodes from soil and roots, killing and fixing of nematodes, staining and separation of nematodes in plants tissue, preparation of temporary and semi-permanent mounts of nematodes, identification of important plant parasitic nematodes, collection and preservation of nematode diseased plant samples; Nematicides and their uses.

Lecture schedule: Theory

S. No.	Topic	No. of lectures
1.	Introduction and economic importance of plant parasitic nematodes.	1

2.	Historic development of Nematology in Indian and Abroad.	1
3.	Salient features and structures of nematode.	1
4.	Outer body tube and related sensory structures.	1
5.	Inner body tube and Digestive system of nematode.	1
6.	Reproductive, excretory and nervous systems.	1
7.	Characters and outline classification of Phylum Nematoda	1
8.	Kinds of parasitism in nematodes.	1
9.	Nematode interaction with other micro-organism.	1
10.	Nematode ecology and Biology.	1
11.	Root-knot disease of vegetables caused by *Meloidogyne* spp.	1
12.	Molya disease of wheat and Barley caused by *Heterodera avenae*.	1
13.	Ear cockle and yellow ear rot diseases of wheat caused by *Anguina tritici* alone and with association of bacterium.	1
14.	Nematode diseases caused by *Rotylenchulus reniformis* and *Tylenchulus semipenetrans*.	1
15.	Principles and various methods of nematode management.	1
16.	Introduction and economic importance of plant parasitic nematodes.	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Study of compound microscope alongwith other laboratory necessaries.	1
2.	Survey, collection of soil samples and plant materials.	1
3.	Extraction of nematodes from soil by direct method.	1
4.	Extraction of nematodes from soil by sieving and decantation method followed by Baermann's funnel technique.	1
5.	Killing and fixing of nematodes.	1
6.	Counting of extracted nematodes.	1
7.	Picking of nematodes.	1
8.	Method of preparation of temporary mount of nematodes.	1
9.	Method of preparation of semi permanent mount.	1
10.	Identification of *Meloidogyne* spp.	1
11.	Identification of *Heterodera avenae*.	1
12.	Method of staining of roots.	1
13.	Preparation of temporary mount of nematodes by teasing the stained root material.	1
14.	Identification of *Anguina tritici*.	1
15.	Types of Nematicides and their uses.	1
16.	Collection, preservation and identification of important nematode plant disease samples.	1

References

1. Reddy, P.P. (1993). A treatise on phyto nematology, Agricol. Publ. Academy, N. Delhi.
2. Walia, R.K. and Bajaj, H.K. (2003). Introduction plant Nematology, ICAR Publication, Krishi Bhawan, New Delhi.
3. Laboratory Manual of Elementary Nematology (Correspondence to course No. NEMAT-411) by Dr. R.L. Midha and Dr. G.L. Sharma (2007).
4. *Mk- xksiky Lo:i ¼1982½ ikni d`f'k foKku] jktLFkku lkfgR; vdkneh] t;iqjA*
5. *Mk- lq'khy dqekj ,oa Mk- ch- ih- flag ikni lw=d`fe foKku ¼2003½] jkekifCyf'kax gkml] esjBA*

STAT 4211 STATISTICS 3(2+1)

Theory:

Introduction: Definition of statistics by seligman and Horac Secrist. Aims, Scope and limitation of statistics. Classification: Definition and its type (According to attributes and class intervals). Measures of central tendency: A.M., G.M., H.M. median, mode, Properties of A.M. Merits, demerits and uses of above measures. Dispersion: range, M.D. Q.D., S.D., variance and c.v., Merits and demerits of above measures. Correlation and regression: scatter diagram, Karl pearson's correlation coefficient, Simple linear regression; regression lines and their fitting,

properties of correlation and regression coefficients. Probability and simple problems based on probability. Test of significance: Null and alternative hypothesis, two types of errors, level of significance, critical region, d.f. standard normal deviate test and students. t-test for single mean and difference between two means, paired t-test. Test of significance of correlation and regression coefficients. Chisquare test for Goodness of fit and fortesting independence of attributes, Yates correction (No mathematical derivatives).

Practical:

Preparation of frequency table of quantitative data. Computation of A.M. for raw data and frequency distribution by direct method and short cut method. Computation of G.M. and H.M. for raw data and frequency distribution. Computation of median and mode for raw data and frequency distribution. Computation of M.D.; Q.D. for raw data and frequency distribution. Computation of S.D. and C.V. for raw data and frequency distribution. Computation of correlation coefficient. Estimation of regression lines, t & S.N.D. test for single mean and difference between two means, paired t-test. Test of significance of correlation and regression coefficients. Chisquare test for Goodness of fit & test of independence in 2x2 contingency table and m x n contingency table.

Lecture Schedule: Theory

S.No.	Topic	No. of lectures
1	Introduction, definition of statistics, scope & limitation of statistics	2
2	Measure of central tendency: A.M., G.M., H.M.	4
3	Mode and median	2
4	Merits and demerits of above measure.	2
5	Measure of dispersion, Range, M.D. and Q.D.	3
6	S.D., variance and C.V.	2
7	Correlation, scatter diagram and Karl pearson's correlation coefficient.	2
8	Regression, regression lines and their fittings.	3
9	Properties of regression coefficient.	1
10	Probability	2
11	Test of significance, hypothesis, type of errors, level of significance, C.R.	2
12	SND test and student's, t-test for single mean.	2
13	SND and t-test for difference between two means.	2
14	Pair t-test.	1
15	Significance test of correlation and regression co-efficient	1
16	Chi-square test for testing independence of attributes and Goodness of fit.	2

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1	Classification of data	1
2	Computation of A.M.	1
3	Computation of Median	1
4	Computation of Mode	1
5	Computation of G.M. and H.M.	1
6	Computation of range & Q.D.	1
7	Computation of M.D.	1
8	Computation of S.D. & C.V.	1
9	Computation of product moment correlation coefficient	1
10	Estimation of line of regression	1
11	Large sample test (S.N.D. test)	1
12	One sample 't' test	1
13	Independent 't' test for two samples	1
14	Paired 't' test	1
15	Test for significance of correlation coefficient and regression coefficient	1
16	Chi-square test	1

References;

1. Chandel, S.R.S. 1998. Handbook of Agril. Statistics. Achal Prakashan Mandir, Kanpur.
2. Gupta S.P. 2002. Statistical Methods. Sultan Chand & Sons, New Delhi.
3. Agarwal B.L. 1991. Basic Statistics Wiley Eastern, New Delhi.

EXTED 4211 Fundamentals of Rural Sociology and Educational Psychology (2+0)

Theory :

Sociology and Rural Sociology- Meaning, Definition, Scope, Importance of rural sociology in Agricultural Extension and Interrelationship between Rural Sociology and Agricultural Extension. Indian 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. Cultural concepts - Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions - Meaning, Definition and their role in Agricultural Extension. Social Values and Attitude - Meaning, Definition, Types and Role of social values and Attitudes in Agricultural Extension. Social Institutions - Meaning, Definition, Major institutions in Rural society, Functions. Social Control - Meaning, Definition, Need and Means of Social control. Social change - Meaning, Definition, Nature of Social change and factors of social change. Leadership- Meaning, Definition, Classification, Roles of Leader, Methods of selection of leaders. Psychology and Educational psychology- Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension. Intelligence - Meaning, Definition, Types, Factors affecting intelligence. Personality- Meaning, Definition, Types, Factors influencing the Personality and Role of Personality in Agricultural Extension. Teaching- Learning process- Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics.

Lecture schedule :Theory

S.No.	Topic	No.of lectures
1.	Sociology and Rural Sociology-Meaning, Definition, Scope,	1
2.	Importance of rural sociology in Agricultural Extension and Interrelationship between Rural Sociology and Agricultural Extension.	1
3.	Indian Rural Society, Important characteristics, differences & Relationship between Rural and Urban societies.	2
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.	Cultural concepts - Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions - Meaning, Definition and their role in Agricultural Extension.	2
7.	Social Values and Attitude - Meaning, Definition, Types and Role of social values and Attitudes in Agricultural Extension.	2
8.	Social Institutions - Meaning, Definition, Major institutions in Rural society, Functions.	3
9.	Social Control - Meaning, Definition, Need and Means of Social control.	2
10.	Social change - Meaning, Definition, Nature of Social change and factors of social change.	2
11.	Leadership- Meaning, Definition, Classification, Roles of Leader, Methods of selection of leaders.	2
12.	Psychology and Educational psychology- Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension.	3
13.	Intelligence - Meaning, Definition, Types, Factors affecting intelligence.	2
14.	Personality- Meaning, Definition, Types, Factors influencing the Personality and Role of Personality in Agricultural Extension.	3
15.	Teaching- Learning process- Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics.	3

References:

1. Bhatia, H.R. 1965. A Text Book of Educational Psychology, Asia Publishing House, New Delhi.
2. Chitamber, J.B., 1990. Introductory Rural Sociology: Willey Easter Ltd. New Delhi.
3. Dhama, O.P. & Bhatnagar, O.P.,1985. Education & Communication for Development, Oxford and IBH Publishing Company, New Delhi,
4. Desai, A.R. 1953. Rural Sociology in India, Vora & Co. Publisher Pvt. Ltd., Bombay.
5. Pujari, D. 2002 Educational Psychology in Agriculture, Agrotech Publishing Academy, Udaipur (Raj.)

HORT 4211 Production Technology of Fruit and Plantation Crops 3(2+1)

Theory:

Importance, introduction and scope of horticulture. Classification of fruits according to climate. Selection of site, planning, establishment and layout of orchard. Propagation methods of fruit crops. Methods of training and

pruning in fruit crops. Use of growth regulators in fruit production. Package of practices for the cultivation of major fruits with the emphasis on botanical name, family, origin, distribution, climate, soil, varieties, propagation, planting, manures and fertilizers, irrigation, training and pruning, intercultural operation, harvesting, yield and plant protection measures including physiological disorders – mango, banana, citrus, grape, guava, sapota, apple, papaya, pineapple, pomegranate, ber, jack, aonla, bael, date palm; plantation crops -coconut, areca nut, cashew, oil palm and tea.

Practical:

Identification of fruit and plantation crops. Study of horticultural tools and implements and their uses; Plant propagation methods, by seeds, cuttings (soft wood, hard wood and semi-hardwood), budding and grafting, layering (simple layering, Air layering,); Layout and planting systems, Methods of pruning and training of important fruit crops .Irrigation methods in fruit crops including drip – Micro irrigation methods for establishment of orchard; Methods of fertilizer application in fruit crops. Visit to local commercial orchards with in state; Preparation of growth regulator solutions for propagation; Application of growth regulators for improving fruit set, fruit size and quality.

Lecture schedule- Theory

S.No.	Topic	No. of lectures
1.	Importance, introduction and scope of horticulture	2
2.	Classification of fruits according to climate.	1
3.	Selection of site	1
4.	Planning, establishment and layout of orchard	1
5.	Propagation methods of fruit crops.	2
6.	Methods of training and pruning in fruit crops	1
7.	Use of growth regulators in fruit production.	1
8.	Package of practices for the cultivation of major fruits with the emphasis on botanical name, family, origin, distribution, climate, soil, varieties, propagation, planting, manures and fertilizers, irrigation, training and pruning intercultural operation, harvesting, yield and plant protection measures including physiological disorders- Mango	2
9.	Banana	1
10.	Citrus	1
11	Grape	1
12	Guava	1
13	Sapota	1
14	Apple	1
15	Papaya	1
16	Pineapple	1
17	Pomegranate	1
18	Ber	1
19	Jack fruit	1
20	Aonla	1
21	Bael	1
22	Date palm	1
	Plantation crops –	
23	Coconut	2
24	Cashew	1
25	Areca nut	1
26	Oil palm	1
27	Tea	2

Lecture schedule-Practical:

S.No.	Topic	No. of lectures
1.	Identification of fruit and plantation crops.	1

2.	Study of horticultural tools and implements and their uses	1
3.	Plant propagation methods by seeds	1
4.	Cuttings (soft wood, hard wood and semi-hardwood)	1
5.	Method of Budding	1
6.	Method of Grafting	1
7.	Method of Layering	1
8.	Simple layering, Air layering other method of Layering	1
9.	Layout and planting systems	1
10	Methods of pruning	1
11	Training of important fruit crops	1
12	Irrigation methods in fruit crops including drip – Micro irrigation	1
13	Methods for establishment of orchard	1
14	Methods of fertilizer application in fruit crops	1
15	Visit to local commercial orchards with in state	1
16	Preparation of growth regulator solutions for propagation; Application of growth regulators for improving fruit set, fruit size and quality.	1

References:

1. Bose. T.K., Kabir.J., Das.P. and Joy.P.P.(2000)Tropical Horticulture. Naya Prokash. Calcutta
2. Singh, Amar (1986) Fruit Physiology And Production. Kalyani Publishers, New Delhi
3. Singh. S.P. (1997) Commercial Fruits. Kalyani Publishers, New Delhi
4. Mitra. S.K., Bose. T.K. and Rathore. D.S. (1991) Temperate Fruits. Horticulture & Allied Publishers, Calcutta
5. Parthasvathy. V. A. Chattopadhyay. P.K. and Bose. T.K. (2006). Plantation Crpos. Naya Prokash, Kolkatta
6. Bal. J.S. (1997) Fruit Growing. Kalyani Publisher, New Delhi
7. Chandra, Atul and Chandra, Anju. Production and Post harvest technology of Fruits. NBS Publisher & Distributers, Bikaner

AGECON 4211 Production Economics and Farm Management 2 (1+1)

Theory:

Production Economics: Meaning, Definition, Nature and Scope of Agricultural Production Economics. Basic concepts and terms. Concepts of Production. Production Functions: Meaning, Definition, Types. Laws of returns: Increasing, Constant and decreasing. Factor Product Relationship. Determination of optimum input and output. Factor relationship. Product relationship. Types of enterprise relationships. Returns to scale: Meaning, Definition, Importance. Farm Management. Economic principles applied to the Organisations of farm business. Types and systems of farming. Farm planning and budgeting. Risk and uncertainty. Farm budgeting. Linear programming: Assumptions, Advantages and Limitations of Linear programming.

Practical:

Computation of cost concepts; Methods of computation of depreciation; Analysis of Net worth statement; Farm inventory analysis; Preparation of farm plans and budgets; Types of farm records and accounts; Preparation of profit and loss account; Break, Even analysis; Economics analysis of different crop and livestock enterprises; Application of Farm Management Principles.

Lecture schedule – Theory

S. No.	Topics	No. of lecture
1.	Meaning, definition, nature and scope of agricultural economics	1
2.	Basic concepts and terms used in production economics and concepts of production	1
3.	Meaning, definition and type of production functions – Linear and Cobb Douglas	1
4.	Law of returns : Increasing, constants, and decreasing	1
5.	Factors – product relationship and determination optimum input and output	1
6.	Factor – factor relationship	1

7.	Product – product relationship	1
8.	Types of enterprise relationship	1
9.	Meaning, definition and importance of returns to scale	1
10.	Meaning and definition of farm management	1
11.	Economic principles applied to the organization of farm business	1
12.	Types and system of farming	1
13.	Farm planning and budgeting	1
14.	Risk and uncertainty	1
15.	Linear programming: assumptions, advantages and limitations of linear programming	2

Lecture schedule – Practical

S.No.	Topics	No. of lecture
1.	Computation of cost concepts	2
2.	Method of computation of depreciations	1
3.	Analysis of Net worth statement	2
4.	Farm inventory analysis	2
5.	Preparation of farm plans and budgets	2
6.	Preparation of farm records and accounts	1
7.	Preparation of profit and loss account	1
8.	Break even analysis	1
9.	Economic analysis of different crop and livestock enterprise	2
10.	Application of various farm management principles	2

References:

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 Agricutural 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".

AENGG 4211 Farm Power and Machinery 2(1+1)

Theory:

Sources of farm power; Scope and development of farm mechanization; Elementary knowledge of principle, operation, types and components of I.C. engines; I.C. engine terminology and related numerical. Different systems of I.C. engines- Air supply and exhaust system; Fuel supply system; Lubricating system; Cooling system; Transmission system; Daily and periodic maintenance of tractors; Tractor driving; Numerical on field capacity and draw bar horse power requirements of implements; Primary tillage implements- tractor drawn mould board plough and disk plough; Secondary tillage implements- cultivators, harrows and hoes; Ferti-seed drill- parts and calibration (including numerical).

Practical:

Identification of engine parts; Study of air and fuel supply system; Study of lubricating and cooling system; Study of transmission system; Tractor driving; Daily and periodic maintenance of tractor; Study of tractor drawn mould board plough and disk plough; Study of different cultivators, harrows and hoes; Study and calibration of seed cum ferti- drill; Estimation of tractor operational cost; Numerical problems on field capacity, field efficiency and power requirement of implements; and numericals on engine terminology.

Lecture schedule: Theory

S. No.	Topic	No. of lectures
1	Sources of farm power; Scope and development of farm mechanization.	1
2	Principle, operation and components of internal combustion engines.	1
3-4	Types of I.C. engines- S.I. and C.I. engines; 2 and 4 stroke engines; valve operating system and valve timing diagram.	2
5-7	I.C. engine terminology and related numerical.	3

8	Air supply and exhaust system- Pre cleaners, oil soaked element type and oil bath type air cleaners; Fuel supply system.	1
9	Lubricating system- splash system and forced feed system; Cooling system-thermosiphon system and forced circulation system.	1
10-11	Transmission system- clutch, gear box, differential, final drive, p.t.o. shaft.	2
12	Daily and periodic maintenance of tractors; Tractor driving.	1
13	Numerical on field capacity and draw bar horse power requirements.	1
14	Primary tillage implements- tractor drawn mould board plough (parts and accessories), plough adjustments; Disk plough.	1
15	Secondary tillage implements- cultivators, harrows and hoes.	1
16	Ferti-seed drill- parts and calibration including numerical.	1

Lecture schedule :Practical

S.No.	Topic	No. of lectures
1.	Identification of engine parts.	1
2.	Study of air and fuel supply systems.	1
3.	Study of lubricating and cooling systems.	1
4.	Study of transmission system.	1
5.	Tractor driving	3
6.	Hitching of implements. (11 Oct.)	1
7.	Daily and periodic maintenance of tractor. (27 Sept.)	1
8.	Study of tractor drawn mould board plough and disk plough.	1
9.	Study of different cultivators, harrows and hoes.	1
10.	Study and calibration of ferti-seed drill.	1
11.	Estimation of tractor operational cost	1
12.	Numercal problems on field capacity, field efficiency and power requirement of implements and engine terminology.	3

Suggested Readings:

1. Principles of Agricultural Engineering. Vol. I. 1987. 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.

SCHEM 4211 Manures and Fertilizers 2(1+1)

Theory

Soil organic matter, Composition, Decomposability, C: N ratio. Soil biology, Biomass, Soil organisms and their beneficial and harmful roles. Raw materials – Manures – Bulky and concentrated – FYM, Composts – Different methods, Mechanical compost plants, Vermicomosting, Green manures, Oil cakes, Sewage and sludge – Biogas plant slurry, Plant and animal refuges. Fertilizers – classifications, Chemistry of manufacturing and properties of major nitrogenous (ammonium sulphate, urea, calcium ammonium nitrate, ammonium nitrate, ammonium sulphate nitrate) phosphatic (single super phosphate, enriched super phosphate, diammonium phosphate, ammonium poly phosphate), potassic and complex fertilizers, their fate and reactions in the soil, Secondary and micronutrients fertilizers, amendments, Fertilizer Control Order, Fertilizer storage; Important Biofertilizers and their advantage.

Practical

Determination of organic carbon and microbial biomass C, N and P. Total nitrogen and phosphorus in manures / composts – Ammoniacal and nitrate nitrogen – Water soluble P_2O_5, potassium, calcium, sulphur and zinc contents of fertilizers, Adulteration in fertilizer.

Lecture schedule: Theory

S. No.	Topic	No. of lectures
1.	Soil organic matter, Composition, Decomposability, C: N ratio.	1
2.	Soil biology, Biomass, Soil organisms and their beneficial and harmful roles. Carbon cycle and C:N ratio and its significance in agriculture	1
3.	Importance and Role of Manures in Sustainable Agriculture	1
4.	Bulky Manures – Raw materials of FYM, compost and vermicompost, method of preparation, uses and nutrient contents	1
5.	Bulky Manures – Raw materials of green manuring and mechanical compost plant, their uses and importance	1
6.	Use of oilcakes, sewage and sludge, bio gas slurry, plant and animal refuges as concentrate organic manure, their importance and nutrient contents	1
7.	Fertilizers – Their importance and classification	1
8.	Chemistry of manufacture of urea, ammonium sulphate and CAN along with their properties, uses and fate in soil	1
9.	Chemistry of manufacture of ammonium nitrate sulphate, their importance, properties, uses and fate in soil	1
10.	Chemistry of manufacture of SSP and enriched super phosphate, their properties, uses and fate in soil	1
11.	Chemistry of manufacture of DAP and ammonium polyphosphate, their properties, uses and fate in soil	1
12.	Chemistry of manufacture of MOP and sulphate of potash, their properties , uses and fate in soil	1
13.	Complex fertilizer – Chemistry of manufacture of nitrophosphate and their properties, uses and fate in soil	1
14.	Secondary and micronutrient fertilizers and their sources and composition	1
15.	Fertilizer control order and fertilizer storage	1
16.	Important bio-fertilizer and their advantages	1

Lecture schedule--Practical

S. No.	Topic	No. of lectures
1.	Determination of organic carbon in soil	1
2.	Determination of microbial biomass C, N & P in soil	3
3.	Determination of total nitrogen in manures	1
4.	Determination of total phosphorus in manures	1
5.	Determination of total potassium in manures	1
6.	Determination of ammonical and nitrate nitrogen in fertilizers	1
7.	Determination of water soluble P_2O_5 in fertilizers	1
8.	Determination of potassium in fertilizers	1
9.	Determination of calcium in fertilizers	1
10.	Determination of sulphur in fertilizers	1
11.	Determination of zinc in fertilizers	1
12.	Determination of adulteration in fertilizers	1
13.	Determination of moisture in fertilizers	1
14.	Methods of inoculation of biofertilizers in seed	1

References:

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B. Sc.

(Hons.) Agriculture,

Part- II IV Semester

AGRON-4221 Field Crops- II (*Rabi*) 3(2+1)

Theory:

Origin, geographical distribution, importance, production in Rajasthan and India, soil and climatic requirements, varieties, cultural practices *viz.* seed and sowing , intercultural operations, fertilizer, water and weed management, plant protection measures; harvesting and yield of wheat, barley; chickpea,; rapeseed and mustard, potato, sugarcane and lucerne; Package of practices of tobacco, sunflower, safflower, linseed, sugarbeet, isabgol , lentil ,berseem ,oats, opium poppy, frenchbean, taramira and peas.

Practical:

Identification of seeds of *rabi* crops ,Seed bed preparation and sowing of wheat and sugarcane ; Calculations on seed rate; Top dressing of nitrogen in wheat and study of fertilizer experiments on *rabi* crops ; Identification of weeds in wheat and other *rabi* crops; Application of herbicides and study of weed control experiments; Morphological characteristics of wheat, barley, oats, rapeseed and mustard ; Yield contributing characters of crops, Judging sugarcane maturity and quality tests .

Lecture schedule :Theory

S.No.	Topic	No. of lectures
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- package of practices	1
28.	Frenchbean - package of practices	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

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Identification of seeds, crops and other inputs of *rabi* crops.	1
2.	Seed bed preparation, germination and purity tests of seed	1
3.	Preparation of seed material for sowing and sowing methods	1
4.	Seed rate and related numerical	1
5.	Seed treatment of crops.	1
6.	Sowing of wheat and planting of sugarcane.	1
7.	Application of herbicides and related numericals.	1
8.	Judging physiological maturity of various crops	1
9.	Fertilizer application in crops and related numerical	1
10.	Morphological difference in wheat, barley and oat, rapeseed and mustard, berseem and lucerne.	1
11.	Judging sugarcane maturity based on brix ratio and related calculation	1
12.	Theoretical yield and related numerical	1
13.	Comparative study of initial and final plant population in the field condition	1
14.	Crop harvesting and related numericals on harvest index.	1
15.	Working out seed index (test weight) and cost of cultivation.	1
16.	Visit of experiments in field	1

References:

1. Singh, Chhidda; Singh P. and Singh, R. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
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10. Rathore, P.S. and Sharma, S.K. 2003. Scientific Pulse Production. Yash Publishing House, Bikaner.
11. Sharma, Kalicharan 1990 Bharat ki promokh faslea. G.B. Pant Agricultural & Technology University, Nanital.
12. Reddy, S.R. 2004. Agronomy of Field Crops. Kalyani Publishers, New Delhi.

AGRON 4222 Water Management 2(1+1)

Theory:

Irrigation: definition and objectives; Water resources and irrigation development in India and Rajasthan; Soil moisture constants and theories of soil water availability; Methods of soil moisture estimation; Evapotranspiration and crop water requirement; Scheduling of irrigation; Methods of irrigation: surface, sprinkler and drip irrigation; Irrigation efficiency and water use efficiency, Irrigation water quality and its management including conjunctive use of water; Water management of different crops (rice, wheat, maize, groundnut, sugarcane, pearlmillet, chickpea, mustard); Agricultural drainage

Practical:

Determination of bulk density by field method; Determination of soil moisture content by gravimetric, tensiometer, electrical resistance blocks and neutron moisture meter methods; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water using different devices; Calculations on irrigation water requirement and irrigation efficiencies (problems); Determination of infiltration rate; Demonstration of border method of irrigation ; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Acquaintance and upkeep of sprinkler and drip irrigation systems; Determination of EC, pH, carbonates biocarbonates and Ca+ Mg in irrigation water (quality parameters).

Lecture schedule: Theory

S.No	Topic	No. of lectures
1.	Irrigation : definition and objectives	1
2.	Water resources and irrigation development in India and Rajasthan.	1
3.	Soil moisture constants and theories of soil water availability	1
4.	Methods of soil moisture estimation: gravimetric , tensiometric , electrical resistance blocks ,neutron moisture meter and pressure plate apparatus.	1
5.	Evapotranspiration-difference between ET and consumptive use and methods of measuring evapotranspiration under field condition	1
6.	Crop water requirement and factors affecting it	1
7.	Scheduling of irrigation : meaning and different approaches for scheduling irrigation in field crops.	1
8.	Surface methods of irrigation ; border , furrow , check basin and basin methods	1
9.	Sprinkler and drip methods; their layout, adaptability , advantages and limitations.	1
10.	Irrigation efficiency ; different terms used and their importance.	1
11.	Water use efficiency -factors affecting and agronomic techniques to boost WUE	1
12.	Irrigation water quality- different criteria and limits used, effect of poor quality water on plant growth .	1
13.	Management practices for efficient use of poor quality waters including conjunctive use of water.	1
14.	Water management in rice, maize, pearlmillet and groundnut.	1
15.	Water management in wheat, chickpea, mustard and sugarcane	1
16.	Agricultural drainage- definition, benefits and different methods of drainage.	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Determination of bulk density by field method	1
2.	Determination of soil moisture content by gravimetric and tensiometric methods	1
3.	Determination of soil moisture content by electrical resistance blocks and pressure plate apparatus	1
4.	Determination of field capacity by field method	1
5.	Determination of permanent wilting point	1
6.	Measurement of irrigation water using different devices.	1
7.	Calculations on irrigation water requirement of crops	1
8.	Calculations on various irrigation efficiencies	1
9.	Determination of infiltration rate of soil	1
10.	Demonstration of border method of irrigation	1
11.	Demonstration of furrow method of irrigation	1
12.	Demonstration of check basin and basin method of irrigation.	1
13.	Acquaintance and upkeep of sprinkler and drip irrigation systems.	1
14.	Determination of EC and pH of irrigation water	1
15.	Determination of carbonates and bicarbonates in irrigation water	1
16.	Determination of Ca + Mg in irrigation water	1

References:

1. Michael, A.M. 1987. Irrigation - Theory and Practice, Vikas Publishing House Pvt. Ltd., New-Delhi.
2. Parihar, S.S. and Sandhu, B.S. 1978. Irrigation of Field Crops- Principles and Practices, ICAR, New-Delhi.

3. Lenka, D. 1999. Irrigation and Drainage . Kalyani Publishers, New-Delhi.
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5. Reddy,S.R. 2000. Principles of Crop Production , Kalyani Publishers, New-Delhi.
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SCHEM 4221 Soil Survey, Land Use Planning and Remote Sensing 2(1+1)

Theory

Soil profile development, soil survey: Significance and purpose of soil survey, methods of soil survey and mapping. Types of soil surveys: Detailed, Reconnaissance, and Detailed—reconnaissance soil survey. Land use planning: Land capability classification, Soil mapping units. Soil survey interpretations and soil survey report. Major soil groups of India with special reference to Rajasthan. Soil taxonomy – a comprehensive US system of soil classification. Remote sensing: concept of remote sensing. Aerial photography, Aerial and satellite sensor imaginary, image processing and interpretations.

Practical

Examinations and description of typical soil profile. Interpretation of topographic map and delineation of physiographic boundaries based on important characters, typifying pedon excavation, examination and classification, interpretation of the identified soil characteristics and their evaluation for land use planning. Preparation of the soil survey report, interpretation of remote sensing information.

Lecture schedule –Theory

S.No.	Topic	No. of lectures
1.	Soil profile development and description	2
2.	Objective and uses of soil survey	1
3.	Purpose and methods of soil survey and mapping procedure	1
4.	Kind of soil surveys: Detailed, Reconnaissance and detailed reconnaissance survey.	1
5.	Soil mapping unit, Soil Survey interpretations for agricultural and non agricultural lands, soil survey report	1
6.	Land use planning: Land capability classification, land capability classes, sub classes and management units	2
7.	Major soil groups of India with special reference to Rajasthan.	1
8.	Soil classifications : Concept and purpose of classification.	1
9.	Soil taxonomy – a comprehensive US system of soil classification	1
10.	Purpose and advantages of 7^{Th} approximation	1
11.	Higher and lower categories of soil classification i.e. order, suborder, great group, sub group, family, series, type and phases, soil moisture and temperature regimes.	2
12.	Aerial photography: Definition, types of aerial photography and satellite, sensor	1
13.	Remote sensing : Definition, type, use and concept of remote sensing Image processing and interpretations	1

Lecture schedule--Practical

S.No.	Topic	No. of lectures
1.	Examinations and description of typical soil profile	2
2.	Interpretation of topographic map and delineation of physiographic boundaries	1
3.	Demarcations for delineation of soil boundaries based as important characters.	1
4.	Determination of EC and pH of soil	1
5.	Determination of calcium carbonate of soil	1
6.	Determination of per cent base saturation	1
7.	Determination of soil colour by munsell soil colour chart	1
8.	Determination of bulk density	1
9.	Determination of particle density and calculation of porosity	1
10.	Determination of hydraulic conductivity and infiltration rate	2

11.	Soil moisture retention at 1/3 and 15 bar	1
12.	Mechanical composition of soil separates by feel method	1
13.	Preparation of soil survey report and interpretation	1
14.	Interpretation of remote sensing information	1

References:

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6. Sehgal, J. (2000) Pedology: Concepts and applications, Kalyani publisher, Ludhiana
7. ISSS (2002) Fundamental of Soil Science Div. of Soil Science, IARI, New Delhi

ENTO 4221 Insect Ecology and Integrated Pest Management Including Beneficia Insects 3 (2+1)

Theory:

Insect Ecology: Definition, scope and concept. Environment and its components. Agroecosystem. Effect of abiotic factors- temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – positive and negative interactions. Causes of pest outbreak. Pest surveillance and forecasting. Categories of pests. **IPM:** Introduction, importance, scope, concepts and limitations. Tools of IPM- Host plant resistance, cultural, mechanical and physical, legislative and biological control (parasites, predators and pathogens such as bacteria, fungi and viruses). Chemical control- Classification, toxicity and formulations of insecticides. Study of important insecticides- Botanicals, chlorinated hydrocarbons, organophosphates, carbamates, synthetic pyrethroids and novel insecticides, chitin synthesis inhibitors, rodenticides, acaricides and fumigants. Hormones and pheromones, repellents, antifeedants, attractants, gamma radiation and genetic control. Insecticides Act 1968- Important provisions. Application techniques of insecticides. Symptoms of insecticide poisoning, first aid and antidotes. **Beneficial insects:** Honeybee- Important species, rearing techniques, diseases and natural enemies. Silkworm- Important species, rearing techniques, diseases and natural enemies. Lac insect- rearing techniques, diseases and natural enemies.

Practical:

Visit to meteorological observatory and IPM laboratory. Pest surveillance through light traps, pheromone traps and field incidence. Study of sampling techniques for the estimation of insect population. Practicable IPM practices-Mechanical, physical and cultural methods Identification and application of parasites and predators. Botanical insecticides- Neem based products Chemical control- Insecticides and their formulations. Handling of plant protection equipments. Calibration of spray equipments. Calculation of doses/concentrations of insecticides. Calculation of doses/concentrations of insecticides. IPM case studies of one important field crop. Poison bait preparation for rodent control and its application. Safe handling of pesticides. Rearing technique for honeybees. Rearing technique for silkworm. Rearing technique for lac insect.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	**Insect Ecology:** Definition, scope and concept.	1
2.	Environment and its components.	1
3.	Agroecosystem.	1
4.	Effect of abiotic factors- temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents.	1
5.	Effect of biotic factors – positive and negative interactions.	1
6.	Causes of pest outbreak	1
7.	Pest surveillance and forecasting	1
8.	Categories of pests	1
9.	**IPM:** Introduction, importance, scope, concepts and limitations.	2
10.	Tools of IPM- Host plant resistance, cultural, mechanical and physical, legislative and biological control (parasites, predators and pathogens such as bacteria, fungi and viruses).	3
11.	Chemical control- Classification, toxicity and formulations of insecticides.	2

12.	Study of important insecticides- Botanicals, chlorinated hydrocarbons, organophosphates, carbamates, synthetic pyrethroids and novel insecticides, chitin synthesis inhibitors, rodenticides, acaricides and fumigants.	5
13.	Hormones and pheromones	2
14.	Repellents, antifeedants, attractants,	1
15.	Gamma radiation and genetic control.	1
16.	Insecticides Act 1968- Important provisions, quarantine rules.	1
17.	Application techniques of insecticides.	1
18.	Symptoms of insecticide poisoning, first aid and antidotes	1
19.	**Beneficial insects:** Honeybee- Important species, rearing techniques, diseases and natural enemies.	2
20.	Silkworm- Important species, rearing techniques, diseases and natural enemies.	2
21.	Lac insect- rearing techniques, diseases and natural enemies.	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Visit to meteorological observatory and IPM laboratory	1
2.	Pest surveillance through light traps, pheromone traps and field incidence	1
3.	Study of sampling techniques for the estimation of insect population	1
4.	Practicable IPM practices-Mechanical, physical and cultural methods	1
5.	Identification and application of parasites and predators	1
6.	Botanical insecticides	1
7.	Chemical control- Insecticides and their formulations	1
8.	Handling of plant protection equipments	1
9.	Calibration of spray equipments	1
10.	Calculation of doses/concentrations of insecticides	1
11.	IPM case studies of one important field crop	1
12.	Poison bait preparation for rodent control and its application	1
13.	Safe handling of pesticides	1
14.	Rearing technique for honeybees	1
15.	Rearing technique for silkworm	1
16.	Rearing technique for lac insect	1

References:

1. Metcalf, R.L and Luckman W.H. 1982. Introduction to Insect Pest Management. Wiley Inter Science publishing, New York.
2. G.S.Dhaliwal and Ramesh Arora 2001. Integrated Pest Management. Concepts and Approaches. Kalyani publishers, New Delhi.
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5. David, B.V. 2003. Elements of Economic Entomology, Popular Book Depot, Chennai.

HORT 4221 Production Technology of Vegetables and Flowers 4(3+1)

Theory:

Importance and scope of Olericulture. Types of vegetable gardening. Classification of vegetables. Package of practices with reference to botanical name, family, origin, distribution, climate, soil, varieties, sowing, manure and fertilizers, irrigation, intercultural operations, harvesting, yield and plant protection measures including physiological disorders for fruit vegetables– tomato, brinjal, chilies, and okra; Cucurbitaceous vegetables- cucumber, ridge gourd, bottle gourd, bitter gourd, melons– water melon, musk melon and round melon, Cole crops– cabbage, cauliflower and knol-khol. Bulb crops– onion and garlic. Beans and peas– French bean, cluster bean, dolichos bean, peas and cowpea. Tuber crops– potato, sweet potato, colocasia,; Root crops– carrot, radish, turnip and beet root; Leafy vegetables– amaranths and palak. Introduction to protected cultivation of important vegetables viz. cucumber, capsicum and tomato. Importance and scope of floriculture. Principles of landscape gardening. Types and styles of ornamental gardening. Planting, care and management of lawn, ornamental trees, shrubs, climbers, palms, indoor- plants and seasonal flowers in the gardens. Package of practices for rose, jasmine, chrysanthemum, marigold and gladiolus. Introduction to protected cultivation of important flower crops viz. rose and gerbera.

Practical:

Planning and layout of kitchen garden; Identification of important vegetable and ornamental plants; trees (shrubs, climbers, house plants, palms etc.,) Raising of vegetable nurseries. Transplanting of vegetable seedlings in main field; Layout of lawns and maintenance; Potting, repotting and maintenance of house plants; Visit to commercial vegetable farms ;Training and pruning of rose (standards, hybrid 'T' roses scented roses) and chrysanthemum (pinching and disbudding); Planning and layout of gardens and garden designs for public and private areas; Harvesting indices of different vegetable crops; Grading and packing of vegetables; Prolonging the shelf life of cut flowers. Visit to different styles and types of gardens.

Lecture schedule- Theory

S.No.	Topic	No. of lectures
1.	Importance and scope of Olericulture	2
2.	Types of vegetable gardening	1
3.	Classification of vegetables	1
4.	Package of practices with reference to botanical name, family, origin, distribution, climate, soil, varieties, sowing, manure and fertilizers, irrigation, intercultural operations, harvesting, yield and plant protection measures including physiological disorders for fruit vegetables – Tomato	2
5.	Brinjal	1
6.	Chilies	1
7.	Okra	1
	Cucurbitaceous vegetables-	
8.	Cucumber, ridge gourd, bottle gourd and bitter gourd	3
9.	**Melons** – water melon, Musk melon and round melon	3
	Cole crops	
10	Cauliflower	1
11	Cabbage and knol-khol	2
	Bulb crops –	
12	Onion	1
13	Garlic	1
	Beans and peas –	
14	French bean, cluster bean and Dolichos bean	2
15	Peas and cowpea	2
	Tuber crops –	
16	Potato	2
17	Sweet potato, colocasia	1
	Root crops –	
18	Carrot and radish	2
19	Turnip and beet root	1
20	Leafy vegetables –	
21	Amaranths and palak	1
	Introduction to protected cultivation of important vegetables -	
22	Cucumber, capsicum and tomato	2
23	Importance and scope of floriculture	1
24	Principles of landscape gardening	1
25	Types and styles of Ornamental gardening	2
26	Planting, care and management of lawn	1
27	Ornamental trees, shrubs and climbers	2
28	Palms, indoor- plants	1
29	Seasonal flowers in the gardens	2
	Package of practices for-	
30	Rose	2

31	Jasmine	1
32	Chrysanthemum,	1
33	Marigold	1
34	Gladiolus	1
	Introduction to protected cultivation of important flower crops-	
31	Rose	1
32	Gerbera	1

Lecture schedule-Practical:

S. No.	Topic	No. of lectures
1.	Planning and layout of kitchen garden	1
2.	Identification of important vegetable	1
3.	Identification of Ornamental plants; trees (shrubs, climbers, house plants, palms etc.,)	1
4.	Raising of vegetable nurseries	1
5.	Transplanting of vegetable seedlings in main field	1
6.	Layout of lawns and maintenance	1
7.	Potting, repotting and maintenance of house plants	1
8.	Visit to commercial vegetable farms	1
9.	Training and pruning of rose (standards, hybrid 'T' roses scented roses) and chrysanthemum (pinching and disbudding);	2
10.	Planning and layout of gardens	1
11.	Garden designs for public and private areas	1
12.	Harvesting indices of different vegetable crops	1
13.	Grading and packing of vegetables	1
14.	Prolonging the shelf life of cut flowers	1
15.	Visit to different styles and types of gardens	1

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2. Chauhan, D.V.S. Vegetable Production in India. Ram Prasad & sons, Agra
3. Bose, T.K. Vegetables. Naya Prokash, Calcutta
4. Singh, S.P. Production Technology of Vegetables Crops. Agril. Res. Communication centre, Karnel
5. Choudhary, B.Vegetables. NBT, New Delhi
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AGECON 4221 Agricultural Finance and Co-Operation 2 (1+1)

Theory:

Agricultural finance: nature and scope. Time value of money, Compounding and Discounting. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4R's 5C's and 7 P's of credit, repayment plans. History of financing agriculture in India. Commercial banks, nationalization of commercial banks. Lead bank scheme, regional rural banks, scale of finance. Higher financing agencies, RBI, NABARD, AFC, Asian Development Bank, World Bank, Insurance and Credit Guarantee Corporation of India. Assessment of crop losses, determination of compensation. Crop insurance, advantages and limitations in application, estimation of crop yields. Agricultural cooperation: philosophy and principles. History of Indian cooperative Movement, pre-independence and post independence periods, cooperation in different plan periods, cooperative credit structure: PACS, FSCS. Reorganisation of cooperative credit structure in Andhra Pradesh and single window system. Successful cooperative systems in Gujarat, Maharastra. Punjab etc.

Practical:

Factors governing use of Capital and identification of credit needs; Time value of money, Compounding and discounting; Tools of financial management, Balance sheet, Income statement and cash flow analysis;

Estimations of credit needs and determining unit costs; Preparations and analysis of loan proposals; Types of repayment loans; Study of financial institutions: PACS, DCCB, Apex Banks, RRBs, CBs, NABARD.

Lecture schedule – Theory

S.No.	Topics	No. of lectures
1.	Nature and scope of agricultural finance	1
2.	Meaning, definition, need and classification of credit	1
3.	4R's, 5C's and 7P's and Repayment plan of credit	1
4.	History of financing agriculture in India	1
5.	Commercial banks, Nationalization of Commercial banks	1
6.	Lead bank scheme, Regional Rural Banks, scale of finance	2
7.	Higher financing agencies, RBI, NABARD	1
8.	Crop insurance advantages and limitation in application, estimation of crop yield	1
9.	Agricultural cooperation philosophy and principles	2
10.	History of Indian co-operative movement Pre-independence and post-independence period	1
11.	Cooperation in different plan periods	1
12.	Cooperation in credit structure: PACS, FSCS	1
13.	Successful cooperation system in Gujarat and Andhra Pradesh	1
14.	Introduction to micro finance and Kishan Credit Cards	1

Lecture schedule – Practical

S.No.	Topics	No. of lectures
1	Estimation of credit needs	2
2.	Preparation and analysis of loan proposals	2
3.	Estimation of repaying capacity	2
4.	Analysis of financial statement	2
5.	Analysis of variance repayment plans of credit	2
6.	Estimation of interest rate and of credit	2
7.	Visit of financial institutions, PACS, RRB, DCCB etc.	4

References :-

1. Reddy, S. and Raghu Ram, P. "Agricultural Finance and Management" Oxford and IBH, New Delhi.
2. Singh, J.P. 1990. "Agricultural Finance – Theory and Practice" Ashish Publishing House, New Delhi
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4. Pandey, Mukesh and Tewari, Deepali "Rural and Agriculture Marketing"
5. Mamoria, C.B. "Agricultural Problems of India"
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7. Nelson, A.G. and Murray, W.G. 1988 "Agricultural Finance" IOWA State University Press, Amies, IOWA, USA

PPHYS 4221 Crop Physiology 3 (2+1)

Theory:

Introduction – Definition of Crop Physiology – Importance in Agriculture and Horticulture. Crop Water Relations – Physiological importance of water to plants – Water potential and its components, measurement of water status in plants. Crop water relations (contd.) Transpiration – Definition – significance – Transpiration in relation to Crop productivity – Water Use Efficiency – WUE in C_3, C_4 and CAM plants – Factors affecting WUE. Photosynthesis – Energy synthesis – Significance of C_3, C_4 and CAM pathway – Relationship of Photosynthesis and crop productivity – Translocation of assimilates – Phloem loading, apoplastic and symplastic transport of assimilates – Source and sink concept – Factors affecting Photosynthesis for productivity – Methods of measuring photosynthesis – Photosynthetic efficiency – Dry matter partitioning – Harvesting index of crops. Photorespiration and crop productivity. Respiration and its significance – Importance of glycolysis, TCA cycle. Pentose Phosphate Pathway – Growth respiration and maintenance respiration, Alternate respiration– Salt respiration–wound respiration – measurement of respiration. Nutriophysiology– Definition – Mengel's classification of plant nutrients – Physiology of nutrient uptake– Functions of Plant nutrients – Deficience and todicity symptoms of plant nutrients – Foliar nutrition – Hydroponics – solution and sand culture. Physiology of flowering – Photoperiodism and Vernalisation in relation to crop productivity – Classification of plants – Commercial application of photoperiodism. Growth and Development – Definition – Types of growth –

Determinate and Indeterminate growth – Monocarpic and Polycarpic species with examples, Measurement of growth – Growth analysis Growth characteristics – Definitions and mathematical formulae. Plant Growth Regulators – Occurrence – Biosynthesis – Mode of action of Auxins, Gibberellins, Cytokinins, ABA, Ethylene. Novel plant growth regulators – Commercial application of plant growth regulator in agriculture and horticulture. Senescence and abscission – Definition – Classification – Theories of mechanism and control of senescence – Physiological and biochemical changes and their significance. Abscission and its relationship with senescence. Seed Physiology – Seed dormancy – Definition – types of seed dormancy – Advantages and disadvantages of seed dormancy - Causes and remedial measures for breaking seed dormancy with examples – Optimum conditions of seed storage – Factors influencing seed storage (ISTA standards). Post Harvest Physiology - Fruit ripening – Metamorphic changes – Climacteric and non-climacteric fruits – Hormonal regulation of fruit ripening (with ethrel, CCC, Polaris, paclobuterozole) – Use of hormones in increasing vase life of flowers.

Practical:

Preparation of solutions. Growth analysis: Calculation of growth parameters. Methods of measuring water status in roots, stems and leaves. Estimation of water potential by Chardakov's method. Measurement of absorption spectrum of chloroplastic pigments and fluorescence. Measurement of leaf area by various methods. Stomatal frequency and index. Leaf anatomy of C_3 and C_4 plants (Demonstration by already prepared slides). Respirometer – measurement of respiration. Measurement of transpiration by different methods. Measurement of respiratory quotient (RQ). Optimum conditions for seed germination. Breaking seed dormancy (a.) Chemical method (b.) Mechanical method. Yield analysis. Seed viability and vigour tests. Effect of ethylene on regulation of stomata.

Lecture Schedule: Theory

S.No.	Topic	No.of lectures
1.	Introduction – Definition of Crop Physiology – Importance in Agriculture and Horticulture	2
2.	Crop Water Relations – Physiological importance of water to plants – Water potential and its components, measurement of water status in plants.	2
3.	Crop water relations (contd.) Transpiration – Definition – significance – Transpiration in relation to Crop productivity – Water Use Efficiency – WUE in C_3, C_4 and CAM plants – Factors affecting WUE.	2
4.	Photosynthesis – Energy synthesis – Significance of C_3, C_4 and CAM pathway – Relationship of Photosynthesis and crop productivity – Translocation of assimilates – Phloem loading, apoplastic and symplastic transport of assimilates – Source and sink concept – Factors affecting Photosynthesis for productivity – Methods of measuring photosynthesis – Photosynthetic efficiency – Dry matter partitioning – Harvesting index of crops.	5
5.	Photorespiration and crop productivity.	1
6.	Respiration and its significance – Importance of glycolysis, TCA cycle. Pentose Phosphate Pathway – Growth respiration and maintenance respiration, Alternate respiration – Salt respiration – wound respiration – measurement of respiration.	3
7.	Nutriophysiology – Definition – Mengel's classification of plant nutrients – Physiology of nutrient uptake – Functions of Plant nutrients – Deficience and todicity symptoms of plant nutrients – Foliar nutrition – Hydroponics – solution and sand culture.	3
8.	Physiology of flowering – Photoperiodism and Vernalisation in relation to crop productivity – Classification of plants – Commercial application of photoperiodism	2
9.	Growth and Development – Definition – Types of growth – Determinate and Indeterminate growth – Monocarpic and Polycarpic species with examples – Measurement of growth – Growth analysis Growth characteristics – Definitions and mathematical formulae.	3
10.	Plant Growth Regulators – Occurrence – Biosynthesis – Mode of action of Auxins, Gibberellins, Cytokinins, ABA, Ethylene. Novel plant growth regulators – Commercial application of plant growth regulator in agriculture and horticulture.	4
11.	Senescence and abscission – Definition – Classification – Theories of mechanism and control of senescence – Physiological and biochemical changes and their significance. Abscission and its relationship with senescence.	1
12.	Seed Physiology – Seed dormancy – Definition – types of seed dormancy – Advantages and disadvantages of seed dormancy - Causes and remedial measures for breaking seed dormancy with examples – Optimum conditions of seed storage – Factors influencing seed storage (ISTA standards).	2
13.	Post Harvest Physiology - Fruit ripening – Metamorphic changes – Climacteric and non-climacteric fruits – Hormonal regulation of fruit ripening (with ethrel, CCC, Polaris, paclobuterozole) – Use of hormones in increasing vase life of flowers.	2

Lecture schedule: Practical

S. No.	Topic	No.of lectures
1.	Preparation of solutions	1
2.	Growth analysis: Calculation of growth parameters	1
3.	Methods of measuring water status in roots, stems and leaves	1
4.	Estimation of water potential by Chardakov's method	1
5.	Measurement of absorption spectrum of chloroplastic pigments and fluorescence	1
6.	Measurement of leaf area by various methods	1
7.	Stomatal frequency and index	1
8.	Leaf anatomy of C_3 and C_4 plants (Demonstration by already prepared slides)	1
9.	Respirometer – measurement of respiration	1
10.	Measurement of transpiration by different methods	1
11.	Measurement of respiratory quotient (RQ)	1
12.	Optimum conditions for seed germination	1
13.	Breaking seed dormancy a. Chemical method b. Mechanical method	1
14.	Yield analysis	1
15.	Seed viability and vigour tests	1
16.	Effect of ethylene on regulation of stomata	1

References:

1. N.K. Gupta & Sunita Gupta, 2004. Plant Physiology. Oxford & IBH Publication, New Delhi
2. R.L. Agarwal, 1995. Seed Technology, Oxford & IBH Publication, New Delhi
3. G.R. Noggle and G.J. Fritz, 1986. Plant Physiology, Prentic Hall of India Pvt. Ltd.
4. J.B. Salisbury and C.W. Ross (1992). Plant Physiology, Wadswar Publishing Company, Belmont, California
5. S.N. Pandey & B.K. Sinha (1995). Vikas Publishing House Pvt. Ltd., New Delhi

EXTED 4221 Entrepreneurship Development and Communication Skills 2(1+1)

Theory :

Communication Skills: Meaning and Process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills. Public speaking. Entrepreneurship Development: Concept & Meaning. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalization and the emerging business / entrepreneurial environment. Entrepreneurial and managerial characteristics; managing an enterprise; motivational drives; entrepreneurial ethics; Entrepreneurship development Programmes- SWOT analysis, generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government Policy on Small and Medium Enterprises (SMEs)/ SSIs. Export and Import Policies. Contract farming and joint ventures, public- private partnerships.

Practical :

Listening and note taking, writing skills, oral presentation skills; field diary and lad record; indexing, footnote and bibliographic procedures. Summarizing, abstracting; individual and group presentation. Practice on SWOT Analysis, visit to SMEs / SSIs.

Lecture schedule :Theory

S.No.	Topic	No.of lectures
1.	Communication Skills: Meaning and Process of communication, verbal and non-verbal communication;	1
2.	Listening and note taking, writing skills, oral presentation skills. Public speaking.	2
3.	Entrepreneurship Development: Concept & Meaning.	1
4.	Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs.	2
5.	Globalization and the emerging business / entrepreneurial environment.	2

6.	Entrepreneurial and managerial characteristics; managing an enterprise; motivational drives; entrepreneurial ethics;	2
7.	Entrepreneurship development Programmes- SWOT analysis, generation, incubation and commercialization of ideas and innovations.	2
8.	Government schemes and incentives for promotion of entrepreneurship.	1
9.	Government Policy on Small and Medium Enterprises (SMEs)/ SSIs.	1
10.	Export and Import Policies. Contract farming and joint ventures, public- private partnerships.	2

Lecture schedule :Practical

S.No.	Topic	No.of lectures
1.	Listening and note taking,	2
2.	Writing skills, oral presentation skills;	2
3.	Field diary and ledger record; indexing, footnote and bibliographic procedures.	3
4.	Summarizing, abstracting;	2
5.	Individual and group presentation.	2
6.	Practice on SWOT Analysis,	2
7.	Visit to SMEs / SSIs	3

References:

1. Akhouri, M.M.P., Mishra, S.P. and Sen Gupta, R. 1989. Trainers Manual on Developing Entrepreneurial Motivation, NIESBUD, New Delhi.
2. Bidgoli, H. 1989. Decision Support Systems: Principles and Practices, St. Paul, West Publishing Co., USA.
3. Goyal, D.P. 1994. Management Information System: Concept and Application, Deep & Deep Publisher , New Delhi.
4. Mancuso, J. 1974. The Entrepreneurs Handbook (Vol. 192(, Artech House, Inc., USA.
5. Patel, V.G. 1987. Entrepeneurship Development Programme in India and Its Relevance to Developing Countries, Entrepreneurship Development Institute of India, Ahmedabad.
6. Rao, T.,V. 1974. Development of an Entrepreneur, Indian Institute of Management, Ahmedabad.
7. Dipak De & M.S. Rao.Entrepreneurial behaviour of farmers : An axiomatic theory. ISBN 81-85694-36-2 , Ganga Kaveri Publishing House, D.35/77, Jangamawadimath, Varanasi-221001 (India), Ph.-0542-2451936.
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

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

V Semester

AGRON 4311 Practical Crop Production -1(*Kharif* crops) 1(0+1)

Practical:
Crop planning, raising field crops in multiple cropping system, Field preparation, seed treatment, nursery raising, sowing, nutrient management, water management, weed management and management of insect pests and diseases of crops; Harvesting, threshing, drying, winnowing, storage and marketing of produce. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of a group of students.

Lecture schedule : Practical

S.No.	Topic	No. of lectures
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

References:

1. Yawalkar, K.S. Agarwal J.P. and Bokde S., 1992, Manures and Fertilizers. Agri-Horticultural Pub. House, Nagpur – India.
2. Balasubramaniyam, P. And Palaniappan, S.P. 2001. Principles and Practices of Agronomy, Agrobios (India), Jodhpur.
3. Reddy, S.R. 2002, Principles of Agronomy, Kalyani Publishers, New Delhi.
4. Singh, S.S. 1993, Principles and Practices of Agronomy, Kalyani Publishers, New Delhi

AGRON 4312 Rainfed Farming 2(1+1)

Theory:

History of rainfed agriculture and its importance in India with particular reference to Rajasthan, extent of problem and constraints related to climate, soil, technological and socio-economic conditions; Delineating criteria for rainfed and drylands; Efficient utilization of water through soil and crop management practices- reducing water losses through mulching (use of mulching), Use of antitranspirants- their kind and mode of action and effect on crop yield; Increasing water storage by reducing run off and increasing infiltration through mechanical and cultural measures; Water harvesting techniques; Watershed management- its concept, objectives and principles; Integrated watershed management for drylands; Efficient management of rainfed crops- land preparation, seeding and crop density, selection of crops and varieties for dryland, alternate cropping and land use strategies, soil fertility management and fertilizer use techniques, weed control and intercultural operations, mid season corrections for mitigating the aberrant weather.

Practical:

Delineating criteria for rainfed and drylands; Onset and withdrawal of the monsoon, amount, intensity and distribution in Rajasthan and India ; Critical analysis of rainfall and estimation of moisture index and aridity index, crops and cropping systems for drylands; Acquiring skill in tillage methods for *in situ* moisture conservation, effects of soil mulching and its effect on soil moisture. Spray of antitranspirants on dryland crops and their effects on crops; Seed soaking and seed treatment with chemicals for sowing under moisture stress conditions, methods of fertilizer application in dry land areas; Effect of plant density, thinning, leaf removal on crop growth under moisture stress condition; Study of the salient features of a model water shed; Alternate land use strategies-- Agro-forestry, grass legume forage and alley cropping systems; Visit to dry land experiments ; to expose students to the latest agro-techniques and watershed management practices; Study of run off plots and soil /nutrient losses.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
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.	Delineating criteria for rainfed and dryland farming	1

4.	Efficient utilization of water by reducing water losses through mulching	1
5.	Use of antitranspirants-their kind, mode of action and effect on crop yield.	1
6.	Increasing water storage and reducing run off and infiltration through mechanical measures	1
7.	Increasing water storage and reducing run off and infiltration through cultural measures	1
8.	Water harvesting techniques in dry farming areas	1
9.	Watershed management- concept, definition, objectives and principles	1
10.	Integrated watershed management for drylands	1
11.	Efficient management of dryland crops viz. land preparation, seeding and crop density	1
12.	Selection of efficient crops and their varieties for dryland farming	1
13.	Alternate cropping and land use strategies for dryland agriculture	1
14.	Soil fertility management and fertilizer use techniques for drylands	1
15.	Weed control and intercultural operations for dry lands	1
16.	Mid season corrections for mitigating the aberrant weather	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Climatic conditions prevalent at the various dry land research centers of the country and delineating criteria for rain fed and dry lands	1
2.	Pattern of rainfall in different dryland tracts of the country	1
3.	Onset and withdrawal of the monsoon, amount, intensity distribution and studies on the effective cropping season	1
4.	Critical analysis of rainfall and estimation of moisture index and aridity index.	1
5.	Spray of antitranspirants on dryland crops and their effect on crops	1
6.	Crops and cropping systems for drylands	1
7.	Acquiring skill in tillage methods for *in-situ* moisture c onservation	1
8.	Mulching and its effects on soil moistures conservation	1
9.	Seed soaking, seed treatment with chemicals for sowing in dryland areas	1
10.	Methods of fertilizer application in dryland areas	1
11.	Effect of plant density, thinning, leaf removal under moisture stress condition on crop growth	1
12.	Study of salient features of a model watershed	1
13.	Alternate land use strategies for dryland areas.	1
14.	Agro forestry, grass legume forage and alley cropping systems.	1
15.	Visit to dryland experiments and watershed management practices	1
16.	Study of runoff plots and soil /nutrient losses	1

References:

1. Singh, R.P. 1995, Sustainable Development of Dryland Agriculture in India. Scientific Publishers, Jodhpur.
2. Singh, S.S., 1993, Crop Management Under Irrigated and Rainfed Conditions, Kalyani Publishers, New Delhi.
3. De, G.C. 1989, Fundamentals of Agronomy Oxford and IBH Publishing Co., New Delhi.
4. Reddy, T.Y. and Reddi, G.H.S. 1992, Principles of Agronomy, Kalyani Publishers, New Delhi.
5. Dhruva Narayan, V.V.; Singh, R.P., Bhardwaj, S.P. Sharma, M. Sikka A.K., Vithal, K.P.R. and Das; S.K. 1947. Watershed Management for Drought Mitigation, ICAR Publication.
6. Murthy, J.V.S. 1994, Watershed Management Wiley, Eastern Limited, New Age International Limited, New Delhi.

BT 4311 Principles of Plant Biotechnology 3(2+1)

Theory:

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering: Scope and importance in crop Improvement : Totipotency and Morphogenesis, Nutritional requirements of in vitro cultures; Techniques of in vitro cultures, Micropropagation, anther culture, pollen culture, ovule culture, embryo culture, Test tube fertilization, Endosperm culture, factors effecting above in vitro cultures, Applications and achievements, somaclonal variation, Types, Reasons, somatic embryogenesis and synthetic seed production technology, Protoplast isolation, culture, manipulation and fusion, Products of somatic hybrids and cybrids,

Applications in crop improvements, Genetic Engineering, Restriction enzymes, Vectors for gene transfer-, gene cloning, Direct and Indirect method of gene transfer-Transgenic plants and their applications. Introductory knowledge about blotting techniques, molecular markers, QTL, Marker assisted selection and application in crop improvement.

Practical:

Requirements of Plant tissue culture laboratory: Techniques in Plant tissue culture- Media Components and preparation; sterilization techniques and inoculation of various explants, callus induction and plant regeneration; Demonstration of Micropropagation, Anther culture, embryo culture, Hardening/ Acclimatization of regenerated plants, somatic embryogenesis and synthetic seed production, Demonstration of isolation and culture of protoplast, demonstration of isolation of DNA, gene transfer technique and gel electrophoresis techniques.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Concepts of Plant Biotechnology	1
2.	History of Plant Tissue Culture and Plant Genetic Engineering: Scope and importance in crop	2
3.	Totipotency and Morphogenesis	1
4.	Nutritional requirements of in vitro cultures	1
5.	Techniques of in vitro cultures	1
6.	Micropropagation	1
7.	Anther culture, pollen culture, ovule culture, embryo culture	1
8.	Test tube fertilization	1
9.	Endosperm culture	1
10.	Factors effecting above in vitro cultures	1
11.	Applications and achievements	1
12.	Somaclonal variation Types, Reasons	1
13.	Somatic embryogenesis	1
14.	Synthetic seed production technology	1
15.	Protoplast isolation, culture, manipulation and fusion	1
16.	Products of somatic hybrids and cybrids	1
17.	Applications in crop improvements	2
18.	Genetic Engineering	2
19.	Restriction enzymes	1
20.	Vectors for gene transfer-, gene cloning	2
21.	Direct and Indirect method of gene transfer	2
22.	Transgenic plants and their applications	2
23.	Introductory knowledge about blotting techniques	1
24.	Molecular markers	1
25.	QTL, Marker assisted selection and application in crop improvement.	2

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Requirements of Plant tissue culture laboratory	1
2.	Techniques in Plant tissue culture	1
3.	Media Components and preparation	1
4.	Sterilization techniques	1
5.	Inoculation of various explants	1
6.	Callus induction	1
7.	Plant regeneration	1
8.	Demonstration of Micropropagation	1
9.	Anther culture	1
10.	Embryo culture	1
11.	Hardening/ Acclimatization of regenerated plants	1
12.	Somatic embryogenesis and synthetic seed production	1
13.	Demonstration of isolation and culture of protoplast	1
14.	Demonstration of isolation of DNA	1
15.	Gene transfer techniques	1

16.	Gel electrophoresis techniques	1

References:

1. Brown, T.A.2001 gene cloning and DNA Analysis-An Introduction, Blackwell Science, London
2. Gupta, P.K.2006. Biotechnology and Genomics, Rastogi Publication, Meerut
3. Prohit, S.S.1997, Biotechnology, Agrobotanical Publication Bikaner
4. Rajdan, M.K.1996, An introduction to, plant tissue culture, Oxford and IBH Publishing Company, New Delhi
5. Ramawat, K.G. 2000, Plant Biotechnology, Kalyani Publishers, Ludhiana
6. Mascarenhas, A.F. 1991. Handbook of Plant Tissue Culture, Publications and Information Division, ICAR, New Delhi.

ENTO 4311 Crop and Stored Grain Pests and Their Management 4 (3+1)

Theory:

Polyphagous pests: Red hairy caterpillar, White grub, Termite, Locust, Grasshopper.**Crop pests:** Distribution, biology, nature and symptoms of damage, and management of insect pests of rice, pearlmillet, sorghum, maize, wheat, sugarcane, cotton, pulses (Gram and *Kharif* pulses), groundnut, castor, sesame, sunflower, mustard, soybean, brinjal, okra, tomato, cruciferous and cucurbitaceous vegetables, potato, chillies, onion, garlic, mango, citrus, pomegranate, guava, ber, apple, coconut and ornamental plants. **Stored grain pests:** Coleopteran and Lepidopteran pests, their identification, biology and damage. Preventive and curative methods for control of stored grain pests.

Practical:

Identification, damage symptoms and management of insect pests of rice, pearlmillet, sorghum, maize, wheat, sugarcane, cotton, pulses, castor, mustard, brinjal, tomato, okra, cruciferous and cucurbitaceous vegetables, onion, garlic, chillies, mango, guava, citrus, pomegranate, ber, coconut. Identification, biology, damage symptoms and management of stored grain and polyphagous insect pests.

Lecture Schedule: Theory

S.No.	Topic	No. of lectures
1	Distribution, biology, nature and symptoms of damage, and management of insect pests of crops Polyphagous pests: Red hairy caterpillar, White grub, Termite, Locust, Grasshopper	6
2	Rice: Brown plant hopper, Yellow stem borer, Rice hispa	3
3	Pearlmillet: White grub (Covered in Polyphagous pests)	
4	Sorghum: Sorghum shoot fly	1
5	Maize: Maize stem borer	1
6	Wheat: Termite (Covered in Polyphagous pests)	
7	Sugarcane: Sugarcane pyrilla, Whitefly, Shoot borer	3
8	Cotton: Jassid, Whitefly, Spotted bollworm, Pink bollworm, Red cotton bug	3
9	Pulses: Gram pod borer, Cutworm, Pea stem fly	3
10	Groundnut: Aphid, White grub (White grub covered in polyphagous pests)	1
11	Castor: Castor semilooper, Capsule borer	1
12	Sunflower: Head borer (Covered in pulses)	
13	Mustard: Aphid, Saw fly, Painted bug	2
14	Tobacco: Tobacco caterpillar (Covered in cruciferous vegetables)	
15	Soybean: Girdle beetle	1
16	Brinjal: Shoot and fruit borer	1
17	Tomato: Fruit borer (Covered in pulses)	
18	Okra: Shoot and fruit borer (Covered in cotton)	
19	Cruciferous vegetables: Cabbage caterpillar, Diamond back moth, Semilooper, Tobacco caterpillar	3
20	Cucurbitaceous vegetables: Melon fruit fly, Red pumpkin beetle, Red vegetable mite	2
21	Potato: Tuber moth	1
22	Chilies: Fruit borer (Covered in pulses)	
23	Onion and Garlic: Thrips	1
24	Mango: Mango hopper, Stem borer, fruit fly	2
25	Citrus: Citrus psylla, Citrus caterpillar	2

26	Guava: Fruit fly (Covered in mango)	
27	Pomegranate: Anar butterfly	1
28	Ber: Fruit fly	1
29	Coconut: Black headed caterpillar	1
30	Apple: San Jose scale, Woolly apple aphid	1
31	Ornamental plants: Rose aphid, hollyhock tinged bug, Jasmine budworm	2
32	Identification, biology and damage of stored grain pests:Khapra beetle, Lesser grain borer, Rice weevil, Red rust flour beetle, Pulse beetle, Rice moth and Angoumois grain moth.	4
33	Preventive and Curative methods for the control of stored grain pests.	1

Lecture Schedule: Practical

S.No.	Topic	No. of lectures
1.	Identification, biology, damage symptoms and management of polyphagous insect pests	3
2.	Identification, biology, damage symptoms and management of insect pests rice, pearlmillet, sorghum, maize, wheat, sugarcane, cotton, pulses, castor, mustard, brinjal, tomato, okra, cruciferous and cucurbitaceous vegetables, onion, garlic, chillies, mango, guava, citrus, pomegranate, ber, coconut.	6
3	Identification, biology, damage symptoms and management of stored grain insect pests.	2
4.	Collection, preservation of insect pests of stored grains, field crops, vegetables and fruit trees.	2
5.	Preparation of spray solutions and numerical problems	2
6.	Field visit of endemic areas	1

References:

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. 2003. Elements of Economic Entomology, Popular Book Depot, Chennai
3. Pradhan, S. 1968. Insect Pests of Crops, National Book Trust, New Delhi
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.II, Kalyani Publishers, New Delhi.
6. Khare, B.P. 1994. Stored Grain Pests and Their Management, Kalyani Publishers, New Delhi.

PBG 4311 Breeding of Field and Horticultural Crops 3 (2+1)

Theory:

Botany and taxonomy, chromosome number, center of origin, species relationship, floral biology, breeding objectives and constraints, disease and pest resistance and quality (physical, chemical, nutritional and marketing) improvement, conventional and non-conventional breeding methods, important varieties and future thrust area in crops like wheat, rice, maize, pearlmillet, gram, moth, groundnut, mustard, cotton, potato, tomato, rose, chillies, cauli flower, coriander, fenugreek, and amla.

Practical:

Study of floral biology, hybridization technique, germplasm and segregating populations. Layout of breeding experiments. Observation recording, analysis and interpretation of breeding trials. Calculation of variability parameters, heterosis and inbreeding depression. Salient features of varieties recommended for the region for the crops as listed in theory portion.viz., rice, wheat, maize, sorghum, groundnut, cotton, potato, tomato, sugarcane, rose, marigold, mango and papaya (available at the time of semester).

Lecture schedule: Theory

S. No.	Topic	No. of lectures
1.	Botany and taxonomy, chromosome number,	2
2.	Center of origin, species relationship, floral biology,	2
3.	Breeding objectives and constraints	1
4.	Disease and pest resistance	2
5.	Quality (physical, chemical, nutritional and marketing) improvement,	2
6.	Conventional and non-conventional breeding methods,	6
7.	Important varieties and future thrust area in crop like wheat, rice, maize, pearl millet, gram, moth, groundnut, mustard, cotton, potato, tomato, rose, chillies, cauli flower, coriander,	17

	fenugreek and amla.	

Lecture Schedule: Practical

S.N.	Topic	No. of Lectures
1.	Study of floral biology, hybridization technique, germplasm and segregating populations.	3
2.	Layout of breeding experiments.	1
3.	Observation recording, analysis and interpretation of breeding trials.	2
4.	Calculation of variability parameters, heterosis and inbreeding depression.	1
5.	Salient features of varieties recommended for the region for the crops as listed in theory portion.viz.wheat, rice, maize, pearl millet, sorghum, groundnut, mustard, cotton, potato, tomato, sugarcane, rose, marigold.	9

References:

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.

AGECON 4311 Agricultural Marketing, Trade and Prices 2 (1+1)

Theory:

Agricultural Marketing: Concepts and Definition, Scope and subject matter, Market and Marketing: Meaning, Definitions, Components of a market, Classification. Market structure, Conduct, performance. Marketing structure, Market functionaries or agencies, Producer's surplus: Meaning, Types of producers surplus, marketable surplus. Marketed surplus, importance, Factors affecting Marketable surplus. Marketing channels: Meaning, Definition, Channels for different products. Market integration, Meaning, Definition, Types of Market Integration. Marketing efficiency: Meaning, Definition, Marketing costs, Margins and price spread, Factors affecting the cost of marketing, Reasons for higher marketing costs of farm commodities, Ways of reducing marketing costs. Theories of International Trade: Domestic Trade, Free trade, International Trade, GATT, WTO, Implications of AOA. Market access, Domestic support, Export subsidies, EXIM-Policy & Ministerial conferences. Cooperative Marketing. State Trading. Ware Housing Corporation; Central and State, Objectives, Functions, Advantages. Food Corporation of India: Objectives and Functions. Quality Control, Agricultural Products, AGMARK. Price Characteristics of agricultural product process, Meaning, Need for Agricultural Price Policy. Risk in Marketing: Meaning and importance, Types of Risk in Marketing. Speculations and Hedging, Futures trading, Contract farming.

Practical:

Identification of marketing channels; Study of Rythu Bazars, Regulated markets; Study of unregulated markets; Study of livestock markets; Price spread analysis; Visit to market institutions, NAFED; Study of SWC, CWC and STC; Analysis of information of daily prices; Marketed and marketable surplus of different commodities.

Lecture schedule – Theory

S.No.	Topic	No. of lectures
1.	Agricultural Marketing; Concepts and Definition, Scope and Subject matter	1
2.	Market and Agricultural Marking : Meaning, Definitions, components and classification of market	1
3.	Market Structure, Conduct, Performance	1
4.	Market functionaries or agencies	1
5.	Producer's Surplus: Meaning, Types of Producer Surplus, Marketable Surplus, Marketed Surplus; importance, factors affecting Marketable Surplus	1

6.	Marketing channels : Meaning, Definition, Channels for different product	1
7.	Marketing integration : Meaning, Definition, Types of Market integration	1
8.	Marketing Efficiency : Meaning, Definition, Marketing costs, Margins and Price spread, factors affecting the cost of Marketing, Reasons for higher marketing costs of farm commodities, ways of reducing marketing costs	1
9.	Meaning of Domestic trade, free trade and International Trade	1
10.	WTO: Implications of AOA, market access, Domestic support, Export subsidies	1
11.	Cooperative Marketing State Trading	2
12.	12. Ware housing Corporation : Central and State, objectives, functions, advantages, Food Corporation of India : objectives and functions	1
13.	Quality control of Agricultural products: AGMARK, price characteristics of Agricultural product process, Meaning and need for Agricultural Price Policy	1
14.	Basic understanding of the terms speculations and Hedging, future Trading, contract Farming	2

Lecture schedule – Practical

S.No.	Topic	No. of lecture
1	Visit of village haat, Regulated Market, Unregulated Market, Live stock markets	6
2	Price spread analysis	2
3	Visit of Market Institutions, NAFED, study of SWC, CWS and STC	6
4	Analysis of daily prices: marketed and marketable surplus of different commodities	2

References

1. S.S. Acharya and N.L. Agarwal (1987) Agricultural Marketing in India, Oxfgord &IBH, 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 Policy in 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

AENGG 4311 Protected Cultivation and Post Harvest Technology 2(1+1)

Theory:

Green house technology- Introduction, types of green houses; Green houses equipments; Material of construction for traditional and low cost green houses; Irrigation systems used in green houses; Introduction: Scope and development of post harvest engineering; Basic engineering properties of cereals; Parts, care and maintenance of threshers and winnowers; Basic concepts and equipments used for cleaning and grading; Conveying equipment; Grain drying- need, methods, factors affecting drying and the different types of dryers; Silos; Grain storage structures and requirements of good storage structure.

Practical:

Determination of basic engineering properties and moisture content of grains; Study of thresher and winnower; Screen cleaners; Air- screen and other cleaners; Conveying equipments; Mechanical dryers; Silos and grain storage structures.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Green house technology- Introduction, types of green houses; Green houses equipments; Material of construction for traditional and low cost green houses; Irrigation systems used in green houses;	2
2.	Introduction: Scope and development of post harvest engineering	1
3.	Basic engineering properties of cereals- Sphericity, Porosity, Angle of repose, Specific heat, Thermal Conductivity, Terminal velocity of objects, Bulk density, Moisture content.	2
4.	Measurement of moisture content.	1

5.	Parts, care and maintenance of threshers.	1
6.	Parts, care and maintenance of winnowers.	1
7.	Basic concepts of cleaning and grading; Screen cleaner; Vibratory and rotary air-screen cleaners.	1
8.	Disk separator, Specific gravity separator, Cylinder separator, Spiral separator, Inclined draper separator, Pneumatic separator, Aspirator separator, Magnetic separator and Cyclone separator; Conveying equipments- Belt conveyor, Screw conveyor and Bucket Elevator.	2
9.	Need, methods, factors affecting grain drying; Full bin, batch and continuous drying.	1
10.	Dryers- Sack dryer, Rotary dryer, PHTC type dryer, LSU dryer and Baffle dryer.	1
11.	Silos- Tower silos and horizontal silos- Trench silos and pit silos, numerical on economical design of silos.	1
12.	Grain storage structures- Bukhari, Kothar, Morai and Bag storage structures; Requirement of good storage structures; Numerical on Bag storage structures.	2

Lecture Schedule: Practical

S.No.	Topic	No. of Lectures
1.	Determination of Basic engineering properties of grains.	1
2.	Determination of moisture content of grains.	1
3.	Study of thresher.	1
4.	Study of winnower.	1
5.	Study of cyclone separator; Study of disk separator	1
6.	Study of spiral separator; Study of conveying equipments	1
7.	Study of mechanical grain dryer	2
8.	Numerical on economical design of pit silos and trench silos	2
9.	Study of Bukhari grain bin	1
10.	Study of Kothar grain bin	1
11.	Study of Morai grain bin	1
12.	Study on bag storage structure capacity	1
13.	Visit to green house structures	2

References:

1. Post Harvest Technology of Cereals, Pulses and Oil Seeds.1999. Chakravarty, A. Oxford and IBH Pub. New Delhi.
2. Agricultural Process Engineering. 1955. Henderson, S.M. and R.L. Perry. John Willy and Sons, New York.
3. Principles of Agricultural Engineering, Vol. I. 1993. Michael, A.M. and T. P. Ojha . Jain Brothers, New Delhi.

PPATH 4311 Disease of Field Crops and Their Management 3(2+1)

Theory:

Economic importance , symptoms , etiology, disease cycle and management of diseases of **Wheat** (rusts, loose smut and Karnal bunt); **Barley** (covered smut and stripe disease); **Bengal gram** (Ascochyta blight and wilt); **Mustard** (white rust, Alternaria blight and white rot); **Rice** (blast, bacterial blight and khaira); **Maize** (brown stripe downy mildew , sugarcane downy mildew and Fusarium stalk rot); **Sorghum** (grain smut , loose smut and anthracnose); **Bajra** (ergot, smut and downy mildew); **Sugarcane** (red rot, whip srnut and grassy shoot disease); **Groundnut** (tikka and collar rot); **Cotton** (root rot ,bacterial blight and leaf curl); **Sesamum** (bacterial leaf blight and phyllody); **Pigeonpea** (wilt and sterility mosaic);**Clusterbean** (Alternaria blight); **Castor** (Fusarium wilt and bacterial blight); **Soybean** (bacterial pustule and charcoal rot); **Moth** and **Mungbean** (yellow mosaic virus).

Practical:

Study of symptoms, etiology, host-parasite relationship and control measures of diseases of wheat, barley, bengal gram, rice, maize, sorghum, bajra, sugarcane, groundnut, cotton, clusterbean, moth and mungbean. Visits of diseased field during the semester. Student should submit at least 25 pressed well mounted disease specimens.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Wheat (rusts, loose smut and Karnal bunt);	4
2.	Barley (covered smut and stripe disease)	2
3.	Bengal gram (Ascochyta blight and wilt);	2
4.	Mustard (white rust, Alternaria blight and white rot)	2
5.	Rice (blast, bacterial blight and khaira)	2
6.	Maize (brown stripe downy mildew and sugarcane downy mildew and Fusarium stalk rot);	3
7.	Sorghum (grain smut , loose smut and anthracnose);	2
8.	Bajra (ergot, smut and downy mildew);	2
9.	Sugarcane (red rot and whip srnut);	1
10.	Groundnut (tikka and collar rot);	2
11.	Cotton (root rot ,bacterial blight and leaf curl)	2
12.	Sesamum (bacterial leaf blight and phyllody)	2
13.	Pigeonpea (wilt and sterility mosaic)	1
14.	Clusterbean (Alternaria blight);	2
15.	Castor (Fusarium wilt and bacterial blight)	1
16.	Soybean (bacterial pustule and charcoal rot);	1
17.	Moth and Mungbean (yellow mosaic virus);	1

Lecture Schedule: Practical.

S.No.	Topic	No. of lectures
1.	Study of symptoms, etiology, host-parasite relationship and specific control measures of the following diseases Diseases of wheat and barley	**2**
2	Diseases of bengal gram (Ascochyta blight and wilt)	**1**
3	Mustard (white rust, blight and white rot)	**2**
4	Diseases of rice and maize	**1**
5	Diseases of sorghum and bajra	**1**
6	Diseases of sugarcane (red rot and whip srnut)	**1**
7	Diseases of groundnut (tikka and collar rot)	**1**
8	Diseases of cotton (root rot ,bacterial blight and leaf curl)	**1**
9	Clusterbean (bacterial blight and Alternaria blight);	**1**
10	Moth and mungbean (yellow mosaic virus);	**1**
11	*Preservation of diseases samples	**2**
12	Field visits at college research farm	**2**

*Note : student should submit at least 25 pressed well mounted disease specimens

Suggested 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 (eds) 2002. Diseases of field crops. Indus Publishing Co. ND.
3 Mehrotra R S and Aggarwal A.2007.Plant Pathology (2nd.ed.) Tata McGraw-Hill Publishing Co Ltd. ND.
4 Mishra A ,Bohra A and Mishra A 2005. Plant Pathology. Agrobios. Jodhpur (India).
5 Rangaswamy ,G and Mahadevan,A .2001. Diseases of crop plants in India. Prentice hall of India Pvt Ltd ND.
6 Singh R S .2007 Plant Diseases.(8th.ed) Oxford and IBH Publishing Co.Pvt .Ltd .ND

HORT 4311 Production Technology of Spices, Aromatic and Medicinal Crops 2 (1+1)

Theory:

Importance and scope of Spices, Aromatic and Medicinal crops. Cultivation technology of Spices, Aromatic and Medicinal crops– ginger, turmeric, pepper, cardamom, coriander, cumin, fenugreek, fennel; Aromatic crops –

lemon grass, citronella, palmarose, vetiver; Medicinal plants –opium, ocimum, aloe, guggal, senna, plantago, stevia, curry leaf, drumstick

Practical:

Identification of spices, aromatic and medicinal plants, Propagation techniques of spices, aromatic and medicinal crops. Propagation and planting methods of turmeric; Harvesting procedures in aromatic plants; Processing and curing of spices (ginger, turmeric and black pepper); Cost of cultivation of spices. Visit to aromatic & medicinal plant nurseries and seed spices field.

Lecture schedule- Theory

S.No.	Topic	No. of lectures
1.	Importance and scope of Spices, Aromatic and Medicinal crops	1
	Cultivation technology of Spices	
2	Ginger	1
3	Turmeric	1
4	Pepper	1
5	Cardamom	1
6	Coriander	1
7	Cumin	1
8	Fenugreek	1
9	Fennel	1
	Cultivation technology of Aromatic crops	
10	Lemon grass	1
11	Citronella	1
12	Palmarose	1
13	Vetiver	1
	Cultivation technology of Medicinal plants	
14	Opium ,Plantago, Stevia	1
15	Ocimum ,Senna, Curry leaf	1
16	Aloe, Guggal, Drumstick	1

Lecture schedule-Practical:

S.No.	Topic	No. of lectures
1.	Identification of spices	1
2.	Identification aromatic plants	1
3.	Identification medicinal plants	1
4.	Propagation techniques of spices,	1
5.	Propagation aromatic and medicinal crops	2
6.	Propagation and planting methods of turmeric	1
7.	Harvesting procedures in aromatic plants	2
8.	Processing and curing of spices (ginger, turmeric and black pepper)	2
9.	Cost of cultivation of spices	2
10.	Visit to aromatic & medicinal plant nurseries and seed spices field	3

References:

1. Sharma, R. (2004). Agrotechniques of Medicinal Plants. Daya Publishing House, Delhi
2. Pruthi, J.S. (1993). Major Spices of India.Crop Management & Post harvest Technology. ICAR, New Delhi
3. Dashora, L.K. Production Technology of Plantation Crops, Spices, Aromatic & Medicinal Plants.

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

AGRON 4321 Practical Crop Production –II *(Rabi)* 1(0+1)

Practical:

Crop planting, raising field crops in multiple cropping systems: Field preparation, seed treatment, nursery raising sowing, fertilizer application, water management, weed management, intercultural operation, management of insect, pest and diseases of crop; Harvesting, threshing, drying, winnowing, storage and marketing of produce; Preparation of balance sheet including cost of cultivation, net return per student as well as per team of a group of students. **Lecture schedule :Practical**

S.No.	Topic	No. of lectures
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

References:

1. Yawalkar K.S., Agarwal, J.P. and Bokde, S. 1992. Manures and Fertilizers. Agri-Horticultural Pub. House, Nagpur- India.
2. Balasubramaniyan, P. and Pallaniappan, S.P. 2001. Principles and Practices of Agronomy, Agrobios (India) , Jodhpur.
3. Reddy ,S.R. 2002 . Principles of Agronomy. Kalyani Publishers, New-Delhi.
4. Singh, S.S. 1993. Principles and Practices of Agronomy, Kalyani Publishers, New-Delhi.

AGRON 4322 Farming Systems, Sustainable Agriculture and Organic Farming 3(2+1)

Theory:

Sustainable agriculture: definition, current concept ; Factors affecting ecological balance and ameliorative measures; Land degradation and conservation of natural resources; Low external input agriculture (LEIA) & high external input agricultural (HEIA); Irrigation problems; Waste lands and their development; Differences between conventional and sustainable agricultural systems; Organic farming: definition, principles , components and relevance in present context; Organic production requirements; Biological intensive nutrient management-organic manures, vermicomposting, green manuring, recycling of organic residues, biofertilizers; Soil amendments; Integrated diseases and pest management – use of biocontrol agents, biopesticides, pheromones, trap crops, bird perches; Organic produce: quality considerations, certification, and accreditation; Farming systems: definition, principles and components, Intergrated farming system (I F S) models for wetland, irrigated dryland and dryland situations.

Practical:

Preparation of cropping scheme for irrigated situations; Preparation of cropping scheme for dryland situations; Study of existing farming systems in nearby villages; Preparation of integrated farming system model for wetlands; Preparation of integrated farming system model for drylands; Preparation of enriched Farm Yard Manure; Preparation of Vermicompost; Study of profitable utilization of agricultural wastes; Visit to poultry and

dairy units to study resource allocation, utilization and economics; Visit to an organic farm to study various components and utilization; Manurial requirement through vermicompost, FYM and poultry manure based on major nutrients; Estimation of organic carbon in organic manures; Technique for treating legume seed with *Rhizobium* and use of *Azotobactor* , *Azospirillum* and PSB in field crops ; Sustainable yield index and sustainable value index ; Productivity index of some important cropping sequences ; Raising of crops organically.

Lecture schedule :Theory

S.No.	Topic	No. of lectures
1.	Sustainable Agriculture-definition & current concept	1
2.	Factors affecting ecological balance and ameliorative measures.	1
3.	Land degradation –a brief introduction	1
4.	Conservation of natural resource _ soil	1
5.	Conservation of natural resource _ water	1
6.	LEIA (Low external input agriculture)	1
7.	HEIA (High external input agriculture)	1
8.	Irrigation problems- quality of irrigation water	1
9.	Waste lands and their development – a brief introduction	1
10.	Organic farming: definition, principles and components and relevance in present context	1
11.	Organic production requirements in the present context.	1
12.	Biological intensive nutrient management _ a brief introduction	1
13.	Vermicomposting	1
14.	Green manuring	1
15.	Organic manure	1
16.	Recycling of organic residues	1
17.	Biofertilizers	1
18.	Soil amendment –acid affected soil	1
19.	Soil amendment –salt affected soil	1
20.	Integrated diseases and pest management: by use of biocontrol agents	1
21.	Biopesticides	1
22.	Pheromones, trap crops, bird perches	1
23.	Quality considerations of organic produce	1
24.	Certification oof organic produce and accreditation processors.	1
25.	Farming systems_ definition and principles	1
26.	Components of farming systems_ introduction.	1
27.	Poultry , piggery, fisheries & duck farming	1
28.	Agroforestry_ introduction	1
29.	Sericulture , apiculture and sheep and goat rearing	1
30.	IFS (Intergrated farming systems) model for wetland.	1
31.	IFS for irrigated drylands	1
32.	IFS for dryland situations	1

Lecture schedule :Practical

S.No.	Topic	No. of lectures
1.	Preparation of cropping scheme for irrigated situations	1
2.	Preparation of cropping scheme for dryland situations	1
3.	Study of existing farming systems	1
4.	Preparation of integrated farming systems model for wetlands	1
5.	Preparation of integrated farming system model for drylands.	1
6.	Preparation of enriched farm yard manure	1
7.	Preparation of vermicompost	1
8.	Study of profitable utilization of agricultural wastes	1
9.	Visit to poultry and dairy units to study resource allocation, utilization and economics.	1
10.	Visit to organic farm to study various components and utilization	1
11.	Manurial requirement through vermicompost, FYM and poultry manure based on major nutrients.	1
12.	Estimation of organic carbon in organic manures	1
13.	Technique for treating legume seed with *Rhizobium* and use of *Azotobactor*, *Azospirillum* and	1

	PSB in field crops	
14.	Calculation of sustainable yield index and sustainable value index	1
15.	Productivity index of some important cropping sequences	1
16.	To become familiar with raising of crops organically	1

References:

1. Panda, S.C. 2004. Cropping Systems and Farming Systems, Agrobios (India), Jodhpur.
2. Sharma, Arun K. 2002. A Handbook of Organic Farming, Agrobios (India) Ltd., Jodhpur.
3. Balasubramaniyan, P. and Palaniappan, S.P. 2004. Principles and Practices of Agronomy, Agrobios (India) ,Jodhpur.
4. Shukla, Rajeev K. 2004. Sustainable Agriculture, Surbhee Publications, Jaipur.
5. Palaniappan, SP. 1985. Cropping Systgems in the Tro;ics : Principles and Management, Wiley Easter Ltd. And TNAU, Ciombatore.
6. Reddy, S.R. 2004. Principles of Agronomy, Kalyani Publishers, Ludhiana.
7. Palaniappan, S.P. and Sivraman, K. 1996. Cropping system in Tropics, International Pvt. New-Delhi.
8. Dahama, A.K. 1999. Organic Farming, Agro Botanic, Bikaner.
9. Sharma, Arun K. 2002. A Handbook of Organic Farming , Agrobios (India) , Jodhpur.
10. Palaniappan, S.P. and Anandurai, K. 1999. Organic Farming- Theory and Practice, Scientific Pub. Jodhpur.
11. Thapa, U and Tripathy, P. 2006. Organic farming In India: Problems and Prospects, Agrotech, Publishning Academy, Udaipur.
12. Gautam , R.C. and Singh, Punjab 1997. Tikau Kheti , Bhartia Krishi Anusandhan Parishad, New-Delhi.
13. Sharma, Arun , K. 2005 . Gevik Kheti- Sindant, Taknik and Upyogita. Agrobios, Jodhpur.

PBG 4321 Principles of Seed Technology 3(2+1)

Theory

Importance of improved seed in agriculture. Seed technology-definition, objective, relationship with other sciences. Seed quality-definition, characters of good quality seed and classes of seed. Seed policy, seed demand forecasting and planning of certified, foundation and breeder seed production. Determination of crop seed varieties, factors affecting deterioration and their control; Maintenance of genetic purity during seed production. Steps involved in development of seed progeramme and seed multiplication. Production of nucleus of & breeder seed, Maintenance and multiplication of pre-release and newly released varieties in self and cross pollinated crops. Seed production- foundation and certified seed production of maize,bajra,sorghum(hybrids,synthetics and composites),rice,cotton,tomoto and hybrids:chillies and cucurbits(varieties and hybrids) : seed production of wheat,barley, gram and rape seed mustard. Seed certification phases of certification, procedure for seed certification and field inspection, fields counts. Seed act 1966 and Seed act enforcement, Central seed committee, Central Seed Certification Board, State Seed Certification Agency.Central and State Seed Testing Laboratories;Duties and powers of seed inspectors,offences and penalities. Seed control order:Seed control order 1983.Intellectual Properties Rights, Patenting,WTO,Plant Breeders Rights and Farmer,s Right.Seed drying-Forced air seed drying,principle,properties of air and their effect on seed drying,moisture equilibrium between seed and air.Seed processing-planning and establishment of seed processing plant;air screen machine and its workingprinciple, different upgrading equipment and their use.Principles of seed treatment , Seed storage; stages of seed storage, factors affecting seed longevity storage and conditions required for good storage, general principles of seed storage. Seed marketing- marketing structure, marketing organization.

Practical:

Seed sampling principles and procedures.Physical purity analysis of field and horticultural crops; Moisture testing; Germination analysis and viability test of field and horticultural crops; Vigour test of field and horticultural crops; KOH and NaOH test for varietal identification; Visit of GOT field at University farms; Varietal identification in seed production plots;Planting ratio,Minimum seed certification standards of important crops in the vicinity.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Importance of improved seed in agriculture	1
2.	Seed technology-definition, objective, relationship with other sciences.	1
3.	Seed quality-definition, characters of good quality seed and classes of seed.	1
4.	Seed policy, seed demand forecasting and planning of certified, foundation and breeder seed	1

	production.	
5.	Determination of crop seed varieties, factors affecting deterioration and their control;	1
6.	Maintenance of genetic purity during seed production.	1
7.	Steps involved in development of seed progeramme and seed multiplication.	1
8.	Production of nucleus and breeder seed	1
9.	Maintenance and multiplication of pre-release and newly released varieties in self and cross pollinated crops.	2
10.	Seed production- foundation and certified seed production of maize, bajra, sorghum(hybrids,synthetics and composites),rice,cotton,tomoto and hybrids:chillies and cucurbits(varieties and hybrids) : seed production of wheat, barley, gram and rape seed mustard.	10
11.	Seed certification phases of certification, procedure for seed certification and field inspection, fields counts.	2
12.	Seed act 1966 and Seed act enforcement,	1
13.	Central seed committee,Central Seed Certification Board,State Seed Certification Agency.Central and State Seed Testing Laboratories;	1
14.	Duties and powers of seed inspectors,offences and penalities	1
15.	Seed control order:Seed control order 1983.	1
16.	Intellectual Properties Rights, Patenting,WTO,Plant Breeders Rights and Farmer,s Right.	1
17.	Seed drying-Forced air seed drying,principle,properties of air and their effect on seed drying,moisture equilibrium between seed and air	1
18.	Seed processing-planning and establishment of seed processing plant;air screen machine and its workingprinciple, different upgrading equipment and their use.	1
19.	Principles of seed treatment	1
20.	Seed storage; stages of seed storage, factors affecting seed longevity storage and conditions required for good storage, general principles of seed storage.	1
21.	Seed marketing- marketing structure, marketing organization.	1

Lecture schedule: Practical

S.N.	Topic	No. of lectures
1.	Seed sampling principles and procedures.	1
2.	Physical purity analysis of field and horticultural crops.	2
3.	Moisture testing.	1
4.	Germination analysis and viability test of field and horticultural crops	3
5.	Vigour test of field and horticultural crops	1
6.	KOH and NaOH test for varietal identification	2
7.	Visit of GOT field at University farms	1
8.	Varietal identification in seed production plots	2
9.	Planting ratio	1
10.	Minimum seed certification standards of important crops in the vicinity.	2

References:

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.

EXTED 4321 Extension Methodologies for Transfer of Agricultural Technology 2(1+1)

Theory :

Communication - Meaning, Definition, Models, Elements and their Characteristics, Barriers in Communication. Extension Programme Planning - Meaning, Definition of Planning, Programme, Project, Principles and Steps in Programme Planning Evaluation - Meaning, concept and types. Extension Teaching methods - Meaning, Definition and Classification. Individual contact methods – Farm and Home visit, Telephone call, E-mail. Group

contact methods – Group discussion, Method and Result demonstrations; Small group discussion techniques – Lecture, Panel, Workshop, Syndicate group, Brain Storming, Seminar, Conference and Buzz group. Mass contact Methods- Campaign, Exhibition, Kisan Mela, Radio & Television -Meaning, Importance, steps, Merits & Demerits. Factors influencing in selection of Extension Teaching methods. Innovative Information sources – Internet, Cyber Cafes, Video and Tele conferences, Kisan call centers. Diffusion-Meaning, Definition and Elements. Adoption Process- Meaning, Stages, Innovation decision process, Adopter categories and their characteristics, Factors influencing adoption process.

Practical:

Organization of Group discussion and Method demonstration. Planning and Writing of scripts for Radio and Television. Preparation of selected audio-visual aids- Charts, Posters, Over Head Projector(OHP) Transparencies, Power Point Slides. Leaflet, Folder, Pamphlet, News Stories and Success Stories. Handling of Public Address Equipment (PAE) System, Still Camera, Video Camera and Liquid Crystal Display (LCD) Projector.

Lecture Schedule :Theory

S.No.	Topic	No.of lectures
1.	Communication - Meaning, Definition, Models, Elements and their Characteristics, Barriers in Communication.	2
2.	Extension Programme Planning - Meaning, Definition of Planning, Programme, Project, Principles and Steps in Programme Planning	2
3.	Evaluation - Meaning, concept and types.	1
4.	Extension Teaching methods - Meaning, Definition and Classification.	1
5.	Individual contact methods – Farm and Home visit, Telephone call, E-mail.	1
6.	Group contact methods – Group discussion, Method and Result demonstrations; Small group discussion techniques – Lecture, Panel, Workshop, Syndicate group, Brain Storming, Seminar, Conference and Buzz group.	3
7.	Mass contact Methods- Campaign, Exhibition, Kisan Mela, Radio & Television -Meaning, Importance, steps, Merits & Demerits.	2
8.	Factors influencing in selection of Extension Teaching methods.	1
9.	Innovative Information sources – Internet, Cyber Cafes, Video and Tele conferences, Kisan call centers.	1
10.	Diffusion-Meaning, Definition and Elements. Adoption Process- Meaning, Stages, Innovation decision process, Adopter categories and their characteristics, Factors influencing adoption process.	2

Lecture schedule :Practical

S.No.	Topic	No.of lectures
1.	Organization of Group discussion	1
2.	Organization of Method demonstration.	1
3.	Planning and Writing of scripts for Radio	1
4.	Planning and Writing of scripts for Television.	1
5.	Preparation of Charts, Posters, Over Head Projector(OHP) Transparencies,	3
6.	Preparation of Power Point Slides.	3
7.	Preparation of Leaflet, Folder, Pamphlet, News Stories and Success Stories.	3
8.	Handling of Public Address Equipment (PAE) System,	1
9.	Handling of Still Camera and Video Camera	1
10.	Handling of Liquid Crystal Display (LCD) Projector.	1

References:

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3. Mathur, K.B. 1994. Communication for Development & Social change, Allied Publisher Ltd., New Delhi.

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5. Sandhu, A.S.1993. Text book on Agricultural Communication : Process & Method, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
6. Reddy, A.A. 1993. Extension Education, Shri Laxmi Press, Baptala.

LPM 4321 Livestock Production and Management 3 (2+1)

Theory:

Place of livestock in the national economy. Different livestock development programs of Government of India. Important exotic and Indian breeds of cattle, buffalo, sheep, goat and swine. Measures and factor affecting fertility in livestock. Reproductive behaviors like puberty, estrus, pregnancy and parturition. Milk secretion, milking of animal and factor affecting milk yield and composition. Selection and breeding of livestock for higher milk and meat production. Feeding and management of calves, growing heifers and milch animals. Housing principles, space requirements for different species of livestock. Disease control measures, sanitation and care. Breeding, feeding and production records. Breed characteristics of poultry. Systems of housing, feeding and management. Incubation, hatching and brooding. Vaccination and prevention of diseases, Preservation and marketing of eggs, its economics and keeping quality. Cost of production of milk.

Practical:

Identification, handling and restraining of farm animals. Judging and culling of dairy cattle and poultry. Feeding and ration formulation for categories of livestock. Housing and management of poultry. Visit to livestock farms. Economics of livestock production.

Lecture schedule- Theory

S. No.	Topic	No. of lectures
1	Place of livestock in the national economy.	1
2	Different livestock development programs of Government of India.	2
3	Important exotic breeds of cattle	1
4	Important Indian breeds of cattle	1
5	Important breeds of buffalo	1
6	Important breeds of sheep	1
7	Important breeds of goat	1
8	Important breeds of swine	1
9	Measures and factor affecting fertility in livestock.	1
10	Reproductive behaviors like puberty, estrus, pregnancy and parturition	1
11	Milk secretion, milking of animal and factor affecting milk yield and composition.	2
12	Selection and breeding of livestock for higher milk and meat production.	1
13	Feeding and management of calves, growing heifers and milch animals.	1
14	Housing principles, space requirements for different species of livestock.	2
15	Disease control measures, sanitation and care of livestock	2
16	Breeding, feeding and production records of livestock	1
17	Breed characteristics of poultry.	2
18	Systems of housing, feeding and management. Incubation, hatching and brooding.	3
19	Vaccination and prevention of diseases in poultry	2
20	Preservation and marketing of eggs, its economics and keeping quality.	4
21	Cost of production of milk	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1	Identification of farm animals	2
2	Handling and restraining of farm animals	2
3	Judging of dairy animals	1
4	Culling of dairy cattle and poultry	2
5	Feeding and ration formulation for different categories of livestock	2
6	Housing of dairy cattle	2
7	Housing management of poultry	2
8	Visit to livestock farms	1
9	Economics of livestock production	2

References:

1. Banerjee, G. C. 2011. A Text Book of Animal HusbandryVIII ed. Oxford and IBH Publications. New Delhi.
2. ICAR. 2011. Hand Book of Animal Husbandry published by DIPA, ICAR, New Delhi.
3. Ranjan, SK.1994 AnimalNutrition and Feeding Practices. Vikash Publications. New Delhi.
4. Sukumar,De. 2000. Outlines of dairy technology. Oxford University Press,New Delhi.
5. Thomus C.K., Sastry NSR and Singh,RA.1982.Farm Animal Management and Poultry Production.Vikash Publications. New Delhi.

ENVS 4321 Environmental Science 3(2+1)

Theory:

Scope and importance of environmental studies and biological chemistry. Renewable resources : Forest, Water, Food, energy and land - various environmental cycles viz. carbon, nitrogen and water etc. Energy flow in the ecosystem : concept of photosynthesis and respiration. Woman and child welfare – food, balance diet, vitamins and minerals etc. HIV/AIDS – viruses and nucleic acids, modification and propagation. Role of information technology on environment and human health – nutrition/malnutrition in communities. Concept of biological processing of industrial wastes. *

Ecology : Definition and scope. Ecosystems: Definition, types, concept, structure, functions, components and food pyramids. Producers, consumers and decomposers of an ecosystem. Bio-diversity: Definition, classification, threats to biodiversity and its conservation. The Environment Protection Act, The Air Act, The water Act, The Wildlife Protection Act and Forest Conservation Act.**

Environmental pollution: Causes, effects and control of air, water, soil, thermal, noise and marine pollution. Causes, effects and management of soil nuclear hazards and industrial wastes.***

Practical:

Estimation of chlorophyll content of fresh water/sea water ecosystem. Study of transpiration and water balance in plants. Estimation of ascorbic acid (Vitamin C). Community survey for nutritional health status. Estimation of proline as stress indicator in plants. *

Estimation of pesticide contamination in Agro-Ecosystem. Determination of sound level by using sound level meter. Estimation of respirable and non respirable dust in the air by using portable dust sampler. Estimation of species abundance of plants. Visit to ecosystems and study of biodiversity. **

Collection, processing and storage of effluent samples; Determination of Bio-Chemical oxygen demand (BOD) in effluent sample; Determination of chemical oxygen demand (COD) in effluent sample; Estimation of dissolved oxygen in effluent samples; Determination of total dissolved solids (TDS) in effluent samples; Estimation of nitrate contamination in ground water. Analysis of temporary and total hardness of water sample by titration. Determination of heavy metals in sewage and sludge. ***

***Bio chemistry ** Entomology *** Soil science**

Lecture schedule –Theory

S. No.	Topic	No. of lectures
*1	Scope and importance of environmental studies and biological chemistry	1
*2	Renewable resources in ecosystems and their importance	1
*3	Biochemical cycles – carbon,nitrogen and water	1
*4	Energy flow and partioning in food chains and energy based classification of ecosystem	1
*5	Concept of Photosynthesis and respiration	1
*6	Food and balanced diet for women and children	1
*7	Role of vitamins and minerals in nutrition	1
*8	HIV/AIDS viruses and their propogation	1
*9	Nucleic acids and modifications of HIV/AIDS viruses	1
*10	Role of information technologies on environment and human health – nutrition /malnutrition in communities	1
*11	Concept of biological processing of industrial wastes	1
**12	Ecology : Definition and scope	1
**13	Ecosystem :Definition, types and concepts	1
**14	Ecosystem structure, functions and components	1
**15	Food pyramids	1
**16	Producers, consumers and decomposers of ecosystem	1
**17	Biodiversity : Definition and classification	1

**18	Threats to biodiversity and its conservation	1
**19	The environmental protection acts	1
**20	The air and water acts	1
**21	The wild life protection acts	1
**22	The forest conservation acts	1
***23	Environmental pollution : Problems and hazards	1
***24	Air pollution causes, effects and control	1
***25	Water pollution causes, effects and control	1
***26	Soil pollution causes, effects and control	1
***27	Thermal pollution causes, effects and control	1
***28	Noise pollution causes, effects and control	1
***29	Marine pollution causes, effects and control	1
***30	Causes, effects and management of soil nuclear hazards	1
***31	Industrial wastes : causes effects and management	2

Lecture schedule –Practical

S. No.	Topic	No. of lectures
*1	Estimation of chlorophyll content of fresh water/sea water Ecosystem	1
*2	Demonstration of transpiration in plants	1
*3	Estimation of ascorbic acids (Vitamin C)	1
*4	Community survey for nutritional health status	1
*5	Estimation of proline as stress indicator in plants	1
**6	Estimation of species abundance of plants	1
**7	Estimation of respirable and non-respirable dust in the air	1
**8	Determination of sound level	1
**9	Estimation of pesticide contamination in agro ecosystem	1
**10	Visit to ecosystems and study of biodiversity	1
***11	Determination of BOD and COD in effluent sample	1
***12	Estimation of dissolved oxygen and TDS in effluent sample	1
***13	Estimation of Nitrate contamination in ground water	1
***14	Analysis of temporary and total hardness of water sample by titration	1
***15	Determination of heavy metals in sewage and sludge	2

References:

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
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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. Fawler, F.B.(1961). Radioactive Fall out, Soils, Plants, Food, Man (Ed.) Elsevier Science, Netherland
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11. Page, R.A.I., Miller, H. and Keeney, D.R., (1992) Methods of Soil Analysis Part-2 (Ed.) American Soc. Agronomy Madison, Wisconch, USA
12. Mishra, P.C.(2001). Soil pollution and Soil Organism, Ashish Publishing House, 8/81, Punjab Bagh, New Delhi – 110026.
13. Pathak, H.and Kumar, S.,(2003). Soil and Green House Effect, CBS Publishers and Distributors, 4596/1-A, 11, Dayaganj, New Delhi – 10002.

HORT4321 Post Harvest Management and Value Addition of Fruits and Vegetables

3(2+1)

Theory:

Importance of post harvest technology in horticultural crops. Maturity indices, harvesting and post-harvest handling of fruits and vegetables. Classification of fruit crops on the basis of ripening and ripening process. Factors affecting ripening of fruits and vegetables. Pre- harvest factors affecting quality on post-harvest shelf-life of fruits and vegetables. Factors responsible for detioration of harvested fruits and vegetables. Chemicals used for hastening and delaying ripening of fruits and vegetables. Primary processing of fruits and vegetables. Methods of storage – pre-cooling, pre-storage treatments, low temperature storage, controlled atmospheric storage, hypobaric storage, irradiation and low cost storage structures. Various methods of packing, packaging materials and transport. Importance and scope of fruit and vegetable preservation in India. Principles of preservation by heat, low temperature, chemicals and fermentation. Unit layout– selection of site and precautions for hygienic conditions of the unit. Preservation through canning, bottling, freezing, dehydration, drying, ultraviolet and ionizing radiations. Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials Spoilage of canned products, biochemical, enzymatic and microbial spoilage. Laws prohibiting processed fruit and vegetables food adulteration in India

Practical:

Practice in judging the maturity of various fruits and vegetables. Construction of zero energy cool chambers for on farm storage. Determination of physiological loss in weight (PLW), total soluble solids (TSS), total sugars, acidity and ascorbic acid content in fruits and vegetables. Effect of ethylene on ripening of banana, sapota and mango. Identification of equipment and machinery used in preservation of fruits and vegetables. Preservation by drying and dehydration. Preparation of jam, jelly and marmalades. Preparation of squash, cordials and syrups. Preparation of chutneys, pickles, sauces and ketchup. Visit to processing units, market yards, cold storage units and packing industries.

Lecture schedule- Theory

S.No.	Topic	No. of lectures
1.	Importance of post harvest technology in horticultural crops	2
2.	Maturity indices, harvesting and post-harvest handling of fruits and vegetables	2
3.	Classification of fruit crops on the basis of ripening and ripening process	2
4.	Factors affecting ripening of fruits and vegetables	1
5.	Pre- harvest factors affecting quality on post-harvest shelf-life of fruits and vegetables	2
6.	Factors responsible for detioration of harvested fruits and vegetables	2
7.	Chemicals used for hastening and delaying ripening of fruits and vegetables	1
8.	Primary processing of fruits and vegetables	1
9.	Methods of storage – pre-cooling, pre-storage treatments, low temperature storage, controlled atmospheric storage, hypobaric storage, irradiation and low cost storage structures	3
10.	Various methods of packing, packaging materials and transport	1
11.	Importance and scope of fruit and vegetable preservation in India	1
12.	Principles of preservation by heat, low temperature, chemicals and Fermentation	1
13.	Unit layout – selection of site and precautions for hygienic conditions of the unit	1
14.	Preservation through canning, bottling, freezing, dehydration, drying, ultraviolet and ionizing radiations	4
15.	Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials	4
16.	Spoilage of canned products, biochemical, enzymatic and microbial spoilage	2
17.	Laws prohibiting processed fruit and vegetables food adulteration in India.	2

Lecture schedule-Practical:

S.No.	Topic	No. of lectures
1.	Practice in judging the maturity of various fruits and vegetables	1
2.	Construction of zero energy cool chambers for on farm storage	1
3.	Determination of physiological loss in weight (PLW), total soluble solids (TSS), total sugars, acidity and ascorbic acid content in fruits and vegetables	2
4.	Effect of ethylene on ripening of banana, sapota and mango	2
5.	Identification of equipment and machinery used in preservation of fruits and vegetables	1

6.	Preservation by drying and dehydration	1
7.	Preparation of jam, jelly and marmalades	3
8.	Preparation of squash, cordials and syrups.	2
9.	Preparation of chutneys, pickles, sauces and ketchup	1
10.	Visit to processing units, market yards, cold storage units and packing industries	1

References:

1. Srivastava, R.P. and Kumar, S. (2007). Fruits and Vegetable Preservation. Principle and Practices. International Book Distributing Comp., Lucknow
2. Lal, G., Siddapa, G.S. and Tandon, G.L. (1967). Fruit and vegetable Preservation in India. ICAR, New Delhi
3. Nair, S.S. And Sharma, H.C. (2006). Phal Tarkari Parikshan Praydhogiki.Rajasthan Hindhi Granth Academy, Jaipur

PPATH 4321 Diseases of Horticultural Crops and Their Management 2(1+1)

Theory: Economic importance, symptoms, etiology, disease cycle and management of diseases of **citrus** (canker,dieback); **mango** (malformation and black tip); **banana** (panama wilt and sigatoka); **grapevine** (downy mildew and anthracnose); **pomegranate** (bacterial blight); **papaya** (foot rot and ring spot); **guava** (wilt and Zn deficiency); **apple** (scab); **ber** (powdery mildew): **potato** (late blight and black heart); **tomoto** (early blight and leaf curl); **chilli** (anthracnose); **brinjal** (Phomopsis blight and little leaf disease); **bhindi** (yellow vein mosaic); **pea** (powdery mildew); **cabbage** (black rot); **cucurbits** (downy mildew); **onion** (purple blotch); **ginger** (rhizome rot) and **rose** (powdery mildew).

Practical: Study of symptoms, etiology, host-parasite relationship and control measures of diseases of citrus, mango, grapevine, pomegranate, papaya, guava, ber, potato, tomoto, chilli, brinjal, bhindi, pea, onion. Field visits at orchards and vegetable fields during the semester.

Lectures schedule: Theory

S.No.	Topic	No. of lectures
1.	Citrus (canker and dieback)	1
2.	Mango (malformation and black tip)	1
3.	Banana (panama wilt and sigatoka)	1
4.	Grapevine (downy mildew and anthracnose), Pomegranate (bacterial blight)	1
5.	Papaya (foot rot and ring spot)	1
6.	Guava (wilt and Zn deficiency);	1
7.	Apple (scab)	1
8.	Ber (powdery mildew)	1
9.	Potato (late blight, and black heart)	1
10.	Tomoto (early blight and leaf curl) Chilli (anthracnose)	1
11.	Brinjal (phomopsis blight and little leaf) Bhindi (yellow vein mosaic)	1
12.	Pea (powdery mildew), Onion (purple blotch)	1
13.	Cabbage (black rot) , Cucurbits (downy mildew)	2
14.	Ginger (rhizome rot)	1
15.	Rose (powdery mildew)	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Study of symptoms, etiology, host-parasite relationship and specific control measures of the following diseases Citrus (canker and dieback)	1
2.	Mango (malformation and black tip)	1
3	Grapevine (downy mildew and anthracnose),Pomegranate (bacterial blight)	1
4.	Papaya (foot rot and leaf curl)	1
5.	Guava (wilt and Zn deficiency);	1

6.	Ber (powdery mildew)	1
7.	Potato (late blight and leaf roll)	1
8.	Tomoto (leaf curl),Chilli (anthracnose)	1
9.	Brinjal (phomopsis blight and little leaf disease),Bhindi (yellow vein mosaic)	1
10.	Pea (powdery mildew), Onion (purple blotch)	2
11.	*Preservation of diseases samples	2
12.	Field visits at orchards and vegetable fields	3

*Note: student should submit at least 25 pressed well mounted disease specimens.

References

1 Gupta, S.K. and Thind, T.S. 2006. Disease problems in vegetable production. Scientific Publishers, Jodhpur.
2 Mehrotra, R.S. and Aggarwal, A. 2007.Plant Pathology (2nd.ed.) Tata McGraw-Hill Publishing Co Ltd., New Delhi.
3 Pathak, V.N. 1980 Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. 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. 2006. Diseases of fruit crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
6 Singh, R.S.1994 Diseases of vegetable crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
7 Singh, R.S. 2007. Plant Diseases. (8th.ed) Oxford and IBH Publishing Co. Pvt . Ltd. New Delhi.

AGECON 4321 Fundamentals of Farm Business Management (including Project Development, Appraisal and Monitoring) 2 (1+1)

Theory -

Agribusiness: Meaning. Definition, Structure of Agribusiness, (Input. Farm. Product Sectors). Importance of Agribusiness in the Indian Economy, Agricultural Policy. Agribusiness Management. Distinctive features, Importance of Good Management. Definitions of Management. Management Functions, Planning. Meaning, Definition, Types of Plans (Purpose or Mission. Goals or Objectives. Strategies, Polices. Procedures, rules. programmes, Budget) characteristics of sound plan, Steps in planning, Organisation. Staffing, Directing. Motivation, Ordering, Leading. Supervision, Communication, control. Capital Management. Financial Management of Agribusiness: Importance of Financial Statements, Balance sheet, Profit and Loss Statement, Analysis of Financial statements. Agro-based Industries: Importance and Need, Classification of Industries, Types of Agro-based Industries. Institutional arrangement, Procedure to set up agro-based industries, Constraints in establishing agro-based industries. Marketing Management: Meaning, Definitions. Marketing Mix. 4Ps of Marketing. Mix, Market segmentation, Methods of Market. Product life cycle. Pricing policy, Meaning. pricing method. Prices at various stages of Marketing. Project, definitions, project cycle. Identification, Formulation. Appraisal, Implementation. Monitoring and evaluation, Appraisal and Evaluation techniques, NPW, BCR. IRR, N/C ratio, sensitivity analysis. characteristics of agricultural projects: preparation of project reports for various activities in agriculture and allied sectors: Dairying, poultry, fisheries. agro-industries etc.

Practical:

Study of input markets: seed. fertilizers, pesticides. Study of output markets. grains, fruits, vegetables, flowers. Study of product markets. retail trade commodity trading, value added products. Study of financing institutions cooperatives commercial banks, RRBs. Agribusiness Finance Limited, NABARD: Preparations of projects. Feasibility reports; Project appraisal techniques: Case study of agro-based industries.

Lecture schedule- Theory

S.No.	Topic	No. of lecture
1.	Agri Business Meaning, Definition, Structure of Agri business (Input. Farm. Products Sectors	1
2.	Importance of Agri Business in the Indian Economy, Agricultural Policy, Agribusiness, Distinctive features ,Management, Distinctive features	1
3.	Importance of Good Management, Definition of Management, Management functions	1
4.	Planning: Meaning, Definitions Types of Plans(Purpose or mission. Goals or Objectives, Strategies, policies, procedures, rules, programmes, Budget), Characteristics of sound plan, steps in planning, organization, staffing, directing, motivation, ordering, supervision, communication, control, capital management	2

5.	Financial Management of Agri-Business: Importance of financial statements, Balance sheet, profit and loss statement, analysis of financial statements	1
6.	Agro based industries, institutional arrangement, procedure to set up agro based industries, Constraints in establishing agro based industries.	2
7.	Marketing management: Meaning, Definitions, Marketing Mix, 4Ps of marketing Mix, Market segmentation, Methods of Market, Product life cycle	2
8.	Pricing policy, Meaning, pricing methods, price at various stages of marketing	1
9.	Project definitions, project cycle, identification, formulation, Appraisal, Implementation, monitoring and evaluation,	2
10.	Appraisal and evaluation techniques, NPW, BCR, IRR, N/K ratio, sensitivity analysis	1
11.	Characteristics of agricultural projects: preparation of project reports for various activities in agriculture and allied sectors: Dairying, poultry, fisheries, agro industries etc.	2

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Study of input markets: seed, fertilizer, pesticides.	3
2.	Study of output markets: grain, fruits, vegetables, flowers	3
3.	Study of product markets. Retail trade commodity trading, value added products.	3
4.	Study of financial institutes cooperatives commercial banks, RRBs, Agribusiness NABARD Financial limited, NABARD	3
5.	Preparation of projects, feasibility reports; project appraisal techniques	2
6.	Case study of agro based industries.	2

References

1. Principles and practice of Marketing in India· C B Mamoria and Joshi
2. Agricultural finance and Management-S Subba Reddy and P Raghu Ram
3. Marketing Agricultural Products - Kohls and Uhl
4. Marketing Management - Kotler

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

VII Semester

AGRON 4411 Applied Weed Management 3(1+2)

Theory:

Weed: definition, damages caused; Elements of weed prevention and control; Concept of Integrated weed management ; Physical weed control methods: manual, mechanical and soil solarization; Weed control through agronomic practices; Biological weed control : Classical approach and bio- herbicides, Herbicidal control; Classes and methods of herbicide application; Sprayers: components and calibration. Weed management in field crops viz., paddy, wheat, maize and millets, groundnut, linseed, rapeseed and mustard, soybean, chickpea, pigeonpea, lentil, sugarcane, cotton, cumin, fenugreek, Lucerne, berseem and vegetable crops; Control of parasitic weeds viz, *Striga, Orobanchae, Cuscutta* , and *Loranthus.*

Practical:

Identification and preservation of seasonal and perennial weeds; Practice in manual and mechanical weed control and use of improved implements; Acquaintance with herbicides – their manufacturers and potential uses; Visit to weed control trials to record observations on density, intensity and dry matter; Herbicide application equipments and their calibration; Herbicide calculations; Herbicide spray in cropped and non- cropped area; Recording herbicide toxicity ; Economics of weed control; Qualitative and quantative analysis of weedy vegetation; Bioassay for herbicide residue estimation; Control of *Parthenium hysterophorous*; Visits to observe weed problems on farmers fields and aquatic ecosystem.

Lecture schedule :Theory

S.No.	Topic	No.of lectures
1.	Weed definition and damages caused	1
2.	Elements of weed prevention and control	1
3.	Physical weed control of weeds	1
4.	Cultural and mechanical weed control and Soil solarization	1
5.	Weed control through agronomic practices	1
6.	Biological weed control and Integrated weed management	1
7.	Herbicidal weed control and limitations	1
8.	Classes and methods of herbicide application	1
9.	Sprayers, their component and calibration	1
10.	Weed management in rice, wheat, maize and millets	1
11.	Weed management in groundnut, linseed. Rapeseed and mustard, soybean	1
12.	Weed management in Chickpea, pigeon pea, lentil	1
13.	Weed management in Sugarcane and cotton	1
14.	Weed management in Cumin, fenugreek, Lucerne, berseem	1
15.	Weed management in vegetable crops	1
16.	Parasitic weeds and their control measures	1

Lecture schedule: Practical

S.No.	Topic	No.of lectures
1.	Identification of common weeds	2
2.	Collection of common *kharif* weeds and their preservation	2
3.	Collection of common *rabi* weeds and their preservation	2
4.	Collection of common perennial weeds and their preservation	2
5.	Different practices of manual and mechanical weed control and use of improved implements	2
6.	Acquaintance with herbicides : their manufacturer and potential uses	2
7.	Visit to weed control trials and recording observations	2
8.	Herbicide application equipments and their calibration	2
9.	Calculation on herbicidal requirement	2
10.	Herbicide spray in cropped and non cropped areas	2
11.	Study of phytotoxicity symptoms of herbicides in different crops	2
12.	Economics of weed control practices	2
13.	Quantitative analysis of weedy vegetation	2
14.	Bioassay for herbicide residue estimation	2
15.	Control measures for *Parthenium hysterophorus*	2
16.	Visit to observe weed problem on farmers field and aquatic ecosystem	2

Reference:

1. Saraswat, V.N., Bhan, V.M. and Yaduraju, N.T. 2003. Weed Management , ICAR, New-Delhi.
2. Gupta, O.P. 2005. Weed Management : Principles and Practices (2nd Ed.), Agribios (India), Jodhpur.
3. Shanmugavelu, K.G., Aravindan, R. and Rajagopal, A. 2004. Weed Management in Horticultural Crops , Agrobios (India), Jodhpur.
4. Gupta, O.P. 2008. Modern Weed Management , Agribios (India), Jodhpur
5. Das, T.K. 2008. Weed Science : Basics and Applications , Jain Brothers, New-Delhi.

PBG 4411 Advanced Seed Technology

Theory:

Heterosis: Inbred line production and maintenance, Production of inbreds by various methods, Evaluation of inbreds,Maintenance of inbreds,Production of hybrids,Emasculation techniques
Use of male sterility, Use of self incompatibility, Maintenance of MS lines, Production of composites and synthetics, Exploitation of apomixes, Visit to seed production units

Seed technology: Setting up of Seed testing laboratory, Different tests of seed quality for seed legislation, Awareness of seed processing equipment, Setting up of seed processing unit, Visit to different seed processing units. **Seed marketing:**Setting up of marketing units, Economics of seed production, Supply chain management, Storage and packaging, Obtaining Licenses for seed production and processing units., Private and public seed production systems. Risk factor analysis in seed business.Model crops for seed production-Wheat, maize, pearl millet, gram, moth, guar and cowpea, rapeseed mustard, cotton, vegetables – tomato, cucurbits, chilli, seed spices.

Practical:

Different methods of emasculation .Setting up of Seed testing laboratory.Different tests of seed quality for seed legislation. Awareness of seed processing equipment. Model crops for seed production. Wheat, maize, pearl millet, gram, moth, guar and cowpea, rapeseed mustard, cotton, vegetables – tomato, cucurbits, chilli, seed spices. Setting up of seed processing unit. Visit to seed production units. Visit to different seed processing units. Demonstration/visit of inbred plots.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Heterosis: Inbred line production and maintenance, Production of inbred by various methods, Evaluation of inbred, Maintenance of inbred	1
2.	Production of hybrids, Emasculation techniques , Use of male sterility Use of self incompatibility, Maintenance of MS lines.	1
3.	Production of composites and synthetics	1
4.	Exploitation of apomixis.	1
5.	Obtaining Licenses for seed production and processing units.	1
6.	Private and public seed production systems. Risk factor analysis in seed business.	2
7.	Setting up of marketing units, Economics of seed production,Supply chain management, Storage and packaging	3
8.	Model crops for seed production-Wheat, maize, pearl millet, gram, moth, guar and cowpea, rapeseed mustard, cotton, vegetables – tomato, cucurbits, chilli, seed spices.	6

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Different methods of emasculation	2
2.	Setting up of Seed testing laboratory	2
3.	Different tests of seed quality for seed legislation	4
4.	Awareness of seed processing equipment	2
5.	Model crops for seed production- Wheat, maize, pearl millet, gram, moth, guar and cowpea, rapeseed mustard, cotton, vegetables – tomato, cucurbits, chilli, seed spices.	15
6.	Setting up of seed processing unit	2
7.	Visit to seed production units	1
8.	Visit to different seed processing units	2
9.	Demonstration/visit of inbred plots	2

References:

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2. Arya, P.S. 2001. Vegetable Breeding and Seed Production. Kalyani Pub., Ludhiana
3. Khare and Bale.2007. Seed Technology. Scientific Publisher (India), Jodhpur
4. Mukharjee, S. The Heterosis Phenomenon. Kalyani Pub., Ludhiana
5. Sreenivas, V.S.2009. Seed Technilogy and Seed Pathology. Oxford Book Comp, Jaipur
6. Saxena,R.P.1984. Beez Sansadhan, GBPA&T, Pantnagar.

SCHEM 4411 Vermicompost and Organic Farming

Theory:

Vermicompost: Definition and objectives of vermitechnology. Importance of vermicomposting in utilization of Agriculture waste and organic recycling of nutrients. Classification of earthworm's. Method of preparation of vermicompost. Method and doses of vermicompost application for cereals, vegetables, tress and pots. Role of vermicomposting in organic farming and soil fertility. **Organic farming:** concept, definition, objectives and scope of organic farming. Role of organic farming in improving soil health and quality. Biofertilizers: Definition, importance of biofertilizers in organic farming and sustainability of soil fertility and productivity. Types of microbiological inoculants and method of application and doses.

Practical:

Identification of earthworms. Preparation of vermicompost. Separation and procurementof vermiculture and vermicompost. Analysis for quality standards and fractionation of vermicompost. Drawing of flow-sheet chart and preparation of vermicompost project. Measurement of changes in bulk density, infiltration rate, water holding capacity and organic carbon content of soil with the application of vermicompost. Determination of organic carbon, N, P and K content of soils under organic farming . Visits of organic farming fields. Identification of different strains of biofertilizers and isolation of rhizobium from nodules.

Lecture schedule :Theory

S.No.	Topic	No.of lectures
1	Definition of vermitechnology	1
2	Importance of vermicompost in utilization of Agriculture waste, and organic recycling of nutrients	2
3	Classification of earth worms	1
4	Method of preparation of vermicompost	1
5	Method and doses of vermicompost application for cereals, pulses, trees vegetables and pots	2
6	Role of vermicomposting in organic farming and soil fertility	2
7	Concept and definition of organic farming	1
8	Objectives and scope of organic farming	2
9	Role of organic farming in improving soil health and quality,	2
10	Definition of biofertilizers and role of biofertilizers in organic farming, sustainable agriculture, soil fertility	2
11	Classification of biofertilizers, methods and doses of application for soil, seed and seedlings.	1

Lecture schedule :Practical

S. No.	Topic	No. of lectures
1	Identification of earthworms	1
2	Collection and preparation of bedding materials	3
3	Preparation of beds for vermicompost and inoculation of vermiculture	2
4	Separation of vermiculture and vermicompost	2
5	Maintenance of vermiculture	1
6	Preservation and packing of vermicompost	2
7	Determination of quality standards of vermicompost: Analysis for N, P and K	4
8	Estimation of organic carbon in vermicompost	1
9	Fractionation of vermicompost	2
10	Drawing of flow-sheet chart of vermitechnology	1
11	Measurement of changes in soil with the application of vermicompost i.e. bulk density, infiltration rate, water holding capacity and organic carbon content of soil.	4
12	Preparation of project for vermicomposting	1
13	Visit and reporting about the productivity of soil under organic farming	2
14	Determination of O.C., N, P and K status of soils under organic farming	5
15	Identification of different strains of bio-fertilizers	1
16	Isolation of Rhizobium from nodules	1

References:

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2. Motsara, M.R. Bhattacharyya, P., Srivastava, Beena (1955) Biofertilizers (Technology, Marketing and as age. Fertilizer development and consultation organization-New Delhi.
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4. Indian standards institution (1986). Indian Standard Specification for Rhizobium inoculants.

SCHEM 4412 Soil Plant and Water Analysis 3 (1+2)

Theory:

Principle of pH meter, EC meter, spectrophotometer, flame photometer and A A S Soil analysis: Objectives, Sampling of soil, procedure and precautions. Interpretation of analytical data and nutrient index Plant analysis: Sampling, stages and plant part to be sampled .Total plant analysis, Quantitative rating of plant analysis data and interpretation of results, critical nutrient concentration (CNC), critical nutrient range (CNR). Nutrient use efficiency. Rapid plant tissue test for N, P, K and their interpretation for fertilizer recommendation,. Visual diagnostic criteria for the nutrient deficiency and toxicity of plants. Errors in soil and plant analysis. Classification and minimization of errors. Water analysis: Quality criteria, classification and suitability of irrigation water and water quality index

Practical:

Standardization of solutions and reagents, collection and preparation of soil samples, estimation of pH, EC, organic carbon, NPKS, micronutrients, CEC and exchangeable sodium in soil. Determination of EC and pH of saturation extract / paste. Estimation of cations(Ca^{++}, Mg^{++} and Na^{+}) and anions (CO_3^{--} and HCO_3^{-}) in saturation extract . Plant sampling and sample preparation for analysis, digestion of plant material and estimation of N, P, K in plant. Rapid plant tissue test for N, P and K Determination of EC, pH, cations (Ca^{++} +Mg^{++} , Na^{+} , K^{+}) and anions (CO_3^{--} , HCO_3^{-} ,Cl^{-}) in irrigation water and.Computation of S A R and R S C .

Lecture schedule: Theory

S.No.	Topic	No.of lectures
1.	Principle of pH meter and EC meter	1
2.	Principle of spectrophotometer, flamephotometer and AAS	1
3.	Soil analysis: Objectives, methods of soil sampling, tools, materials and precautions in soil sampling	1
4.	Interpretation of analytical data for evaluation of soil fertility and nutrient index	1
5.	Plant analysis: Sampling, stages and plant part to be sampled	1
6.	Preparation of plant samples for analysis by ashing and digestion.	1
7.	Total plant analysis, Quantitative rating of plant analysis data and interpretation of results, critical nutrient concentration, critical nutrient range. Nutrient use efficiency	2
8.	Rapid plant tissue test for N, P, K and their interpretation as a guide to fertilizer recommendation. Advantage and disadvantage of rapid plant tissue test	2
9.	Visual symptoms of nutrients deficiency or toxicity and critical limits of major nutrients in plants	1
10.	Visual symptoms of nutrients deficiency or toxicity and critical limits of micro nutrients in plants	1
11.	Errors in soil and plant analysis, precision and accuracy classification and minimization of errors	2
12.	Water analysis: Quality criteria, classification and suitability of irrigation water. Water quality index	2

Practical schedule: Practical

S.No.	Topic	No.of lectures
1	Standardization of solutions and reagents	2
2	Collection and preparation of soil sample	1
3	Mechanical analysis of soil by international pipette method	2
4	Estimation of pH and electric conductivity of soil suspension	1
5	Estimation of organic carbon in soil	1
6	Estimation of available nitrogen in soil	1
7	Estimation of available phosphorus in soil	2
8	Estimation of available potassium in soil	1

9	Estimation of available sulphur in soil	2
10	Estimation of micronutrients (Zn, Mn, Cu and Fe) in soil	2
11	Estimation of available boron in soil	2
12	Estimation of cation exchange capacity in soil	1
13	Estimation of exchangeable sodium in soil and computation of ESP	1
14	Preparation of soil saturation paste and extract	1
15	Determination of EC and pH in saturation extract / paste	1
16	Estimation of cations (Ca^{++}, Mg^{++} and Na^{+}) and anions (CO_3^{--} and HCO_3^{-}) in saturation extract	2
17	Estimation of nitrogen in plant	2
18	Estimation of phosphorus in plant	2
19	Estimation of potassium in plant	1
20	Rapid plant tissue test for nitrate, phosphate and potassium	1
21	Estimation of Ca^{++} and Mg^{++} in irrigation water	1
22	Estimation of Na^{+} and K^{+} in irrigation water and computation of SAR	1
23	Estimation of CO_3^{--}, HCO_3^{-} and Cl^{-} in irrigation water and computation of RSC	1

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SCHEM 4413 Soil Management 3 (1+2)

Theory:

Soil resources of India; distribution of wasteland and problematic soils with special reference to Rajasthan; soil tilth management; soil crusting and its management; management of soil moisture under different climates; effect of water quality on soils and plants; soil aeration problems and management; soil thermal regimes in relation to crops and their optimization.

Recycling of agricultural and industrial wastes, waste land and their management; reclamation and management of acidic, saline and sodic soils, constraints and management of highly and slowly permeable soils; soil erosion, extent, type and effects, soil conservation technique, water harvesting techniques and watershed management, remote sensing for soil and watershed management.

Practical:

Determination of saturated hydraulic conductivity, bulk density measurement of soil measurement of water holding and field capacities of soil, measurement of infiltration rate and moisture retention characteristics curve in normal, problematic and reclaimed soils. Preparation of saturation paste and saturation extracts of salt affected soils. Determination of pH, EC, cations and anions in saturation extract. Determination of $CaCO_3$ equivalent of liming material. Estimation of lime requirement of acid soils and gypsum requirement of sodic soils. Measurement of ODR of soil. Estimation of water stable aggregate in soil and field trip to study the areas of problematic soils.

Lecture schedule :Theory

S.No.	Topic	No.of lectures
1.	Soil resources of India; distribution of wasteland and problem soils	1
2.	Soil tilth management, soil crusting and their management	1
3.	Soil water: classification, and its measurement, forces of soil water retention, moisture retention curve and management of soil moisture under different climates.	2
4.	Quality of irrigation water: Criteria and classification of poor quality water, effect of poor quality of water on soil and crop growth, management of poor quality water	2

5.	Soil air: Composition of soil air, gaseous exchange in soil and management of soil aeration in relation to plant growth	1
6.	Soil temperature and thermal regimes in relation to crop growth, factors affecting soil temperature and optimization of soil thermal regimes.	1
7.	Recycling of Agricultural and industrial organic waste.	1
8.	Acid soils: Extent, reclamation and management in India.	1
9.	Nomenclature, classification and formation of salt affected soils in India and Rajasthan, visual and chemical methods of diagnosing salt affected soils.	1
10.	Reclamation and management of salt affected soils	2
11.	Highly and low permeable soils: constraints and their management	1
12.	Soil Erosion: Extent of soil erosion, types of soil erosion, causes of soil erosion, prevention and management of soil erosion.	2
13.	Water harvesting and watershed management, concept, objectives and approach.	1
14.	Use of remote sensing in assessment and planning of waste land and watershed management.	1

Lecture schedule :Practical

S.No.	Topic	No.of lectures
1.	Techniques of reclamation / management of problematic soils	4
2.	Determination of saturated hydraulic conductivity of normal, problematic and reclaimed soil.	3
3.	Determination of bulk density of soil by core sampler method in normal, problematic and reclaimed soil.	3
4.	ermination of soil moisture at 1/3 and 15 bar by pressure plate method in normal, problematic and reclaimed soil.	2
5.	Measurement of water holding capacity and field capacity of soil	3
6.	Measurement of infiltration rate of soil by double ring infiltrometer in normal, problematic and reclaimed soil.	
7.	Preparation and analysis of saturation extract and determination of EC, pH	1
8.	Determination of Ca + Mg and Na in saturation extract and computation of SAR	2
9.	Determination of CO_3, HCO_3 and Cl in saturated extract.	2
10.	Determination of $CaCO_3$ equivalent of liming material	3
11.	Estimation of lime requirement of acid soils	1
12.	Estimation of gypsum requirement of sodic soils	1
13.	Measurement of ODR of soil in normal, problematic and reclaimed soil	1
14.	Estimation of water stable soil aggregates in normal, problematic and reclaimed soil	2
15.	Field demonstration to study the problematic soil and managed area /watershed management	2

References:

1. Abrol, I.P. and Dhurva narayana, V.V. (1998) Technologies for wasteland development, ICAR, New Delhi-110012
2. Agarwal, R.R., Yadav, J.S.P. and Gupta, R.N. (1982). Saline Alkali soils of India, ICAR, New Delhi.
3. Biswas, T.D. Naryanswami, G, Goswami, N.R; Sekhon, G.S. and Shastry, T.G. (1991). Soil related constraints in crop production. Tech. Bull. No. 15. Indian Society of Soil Science, New Delhi.
4. Biswas, T.D. and Mukharjee, S.K. (1990). Text book of soil science, Tata Mc Graw till publishing co. Ltd. New Delhi.
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7. Richards, L.A. (1954). Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.
8. Somani, L.L. and Totawat, K.L. (1993). Management of salt affected soils and waters. Agrotech publishing Academy, Udaipur.

LPM 4411 Dairy Cattle Production 3(1+

Theory:

Importance of dairying. Important milch breeds of cattle and buffalo. Selection, purchase and insurance of dairy animals. Scientific management of calves, heifers, bull calves, dry, pregnant and lactating dairy animals.Least cost ration formulation. Systems of breeding. Factors affecting productive and reproductive efficiency of dairy animals.

Practical:

Selection of site for dairy farm.Layout of dairy farm building.Computation and formulation of milk replacer, calf starter, concentrate mixture for lactating, pregnant and dry animals. Computation of balance ration for various categories of dairy animals. Physical and chemical treatment of low quality roughages. Plan for supplying green fodder throughout the year.Vaccination in various categories of dairy animals. Dehorning in dairy calves. Castration of male calves. Control of ecto and endo parasites. Colostrums and its utility. Weaning and rearing of dairy calves. Determination of age of animal. Care and management of dairy calves. Management of lactating, dry and pregnant cows. Dairy hygiene. Clean milk production and its marketing. Cleaning and sanitization of dairy equipments. Milking machine and its operation. Management of milch animals during adverse climatic conditions. Symptoms of estrus in dairy animals. Pregnancy diagnosis. Artificial insemination and its importance. Hay and silage making. Temperature, pulse and respiration rate in dairy animals.

Lecture schedule- Theory

S.No.	Topic	No. of lectures
1	Importance of dairying.	2
2	Important milch breeds of cattle and buffalo.	2
3	Selection, purchase and insurance of dairy animals.	2
4	Scientific management of calves, heifers, bull calves, dry, pregnant and lactating dairy animals.	4
5	Least cost ration formulation.	2
6	Systems of breeding.	2
7	Factors affecting productive and reproductive efficiency of dairy animals.	2

Lecture schedule-Practical:

S.No.	Topic	No. of lectures
1	Selection of site for dairy farm.	1
2	Layout of dairy farm building.	1
3	Computation and formulation of milk replacer, calf starter, concentrate mixture for lactating, pregnant and dry animals.	2
4	Computation of balance ration for various categories of dairy animals.	2
5	Physical and chemical treatment of low quality roughages.	2
6	Plan for supplying green fodder throughout the year.	2
7	Vaccination in various categories of dairy animals.	2
8	Dehorning in dairy calves.	1
9	Castration of male calves.	1
10	Control of ecto and endo parasites.	1
11	Colostrums and its utility.	1
12	Weaning and rearing of dairy calves.	1
13	Determination of age of animal.	1
14	Care and management of dairy calves.	2
15	Management of lactating, dry and pregnant cows.	2
16	Dairy hygiene..	1
17	Clean milk production and its marketing.	1
18	Cleaning and sanitization of dairy equipments.	1
19	Milking machine and its operation.	1
20	Management of milch animals during adverse climatic conditions.	1
21	Symptoms of estrus in dairy animals.	1
22	Pregnancy diagnosis.	1
23	Artificial insemination and its importance.	1
24	Hay and silage making. Temperature, pulse and respiration rate in dairy animals	2

References:

1. Banerjee, G. C. 2011. A Text Book of Animal Husbandr.VIII ed. Oxford and IBH Publications. New Delhi.
2. ICAR. 2011. Hand Book of Animal Husbandry published by DIPA, ICAR, New Delhi.
3. Ranjan, S.K.1994 AnimalNutrition and Feeding Practices. Vikash Publications. New Delhi.
4. Singh, R A 1985. Poultry Prodution. Kalyani Publications.New Delhi.
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PHYS 4411 Plant Growth Regulators in Agriculture 3 (1+2)

Theory:

Introduction and historical background of Plant growth regulators. Classification of plant hormones and their synthetic analogues. Surfactants – Physiology and performance. Plant hormones vis-à-vis control of flowering and sex expression. Role of plant hormone in seed, fruit and grain formation. Weed control and plant hormones. Economic and social aspects of PGRs applications

Practical:

Methods of application of synthetic plant hormones and precautions. Doses, responses and growth stages for the application of hormones. Plant hormones and propagation through cell, tissue, organ culture and differentiation. Plant hormones vis-à-vis seed and propagule storage. Abiotic and biotic stress management through plant hormones. Vist to orchards for demonstration of flower and fruit drop and their control measures.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Introduction and historical background of Plant growth regulators	1
2.	Classification of plant hormones and their synthetic analogues	3
3.	Surfactants – Physiology and performance	1
4.	Plant hormones vis-à-vis control of flowering and sex expression	3
5.	Role of plant hormone in seed, fruit and grain formation	3
6.	Weed control and plant hormones	3
7.	Economic and social aspects of PGRs applications	2

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Methods of application of synthetic plant hormones and precautions	7
2.	Doses, responses and growth stages for the application of hormones	5
3.	Plant hormones and propagation through cell, tissue, organ culture and differentiation	7
4.	Plant hormones vis-à-vis seed and propagule storage	6
5.	Abiotic and biotic stress management through plant hormones	4
6.	Vist to orchards for demonstration of flower and fruit drop and their control measures	3

References:

1. Krishanamurthy, H.N. (1994) Plant growth and development Narosa Publication, New Delhi.
2. Kumar Arvind and Purohit S.S. (1996) Plant Physiology, Agrobotanica Publishers, Jodhpur.

AENGG 4411 Plasticulture in Agriculture 3(1+2)

Theory:

Introduction of Plasticulture, Types and quality of plastics used in agriculture, Quality control measures, Present status and future prospective of plasticulture in India, Use of plastics in water management and in -situ moisture conservation, Plastic pipes for sub-surface drainage, Plastic film lining in canal, pond or water reservoir. Plastic mulch technique, Use of plastic in nursery raising, Plastics as cladding material for controlled

environmental cultivation- poly houses, shade net houses, poly tunnels, low tunnels and crop covers. Plastic nets for crop protection - anti insect nets, bird protection nets. Plastic fencing. Innovative packaging solutions- leno bags, carets, vacuum packing .Plastic cap covers for storage of food gain in open. Use of plastics in farm equipments and machineries - sprayers, seed drill tubes and other spare parts of equipments and machineries. Plastic vermi-beds. Silage film technique for fodder preservation. Agencies involved in the promotion of plasticulture at national and state level.

Practical:

Study of sub- surface drainage system model, design of farm pond and estimation of plastic film, laying and flushing of drip laterals, plastic mulch laying, construction of low tunnels, use of leno bags, design, installation and cost estimate of cap cover, use of plastic in nursery under anti insect/ bird protection net, use of plastic vermi-bed, use of silage film for fodder preservation, visit to a nearby- PVC pipe manufacturing unit/dealer/ farmer' s field, sprinkler manufacturing unit/ dealer, poly house, shade net house.

Lecture schedule: Theory

S.No.	Topic	No. of lectures
1.	Plasticulture-meaning. Types and quality of plastics used in agriculture. Various fields for plasticulture applications. Major benefits of plasticulture application	1
2.	Present status and future prospective of plasticulture in India. Quality control measures associated with environmental protection.	1
3.	Use of plastic for water conveyance - plastic pipelines for water conveyance. PVC pipes for underground lines, HDPE pipe roll, hose pipes, PVC foot valves, and fittings of PVC pipelines. Repair and maintenance of PVC pipes. Concept of SSD system, sub-surface drainage concept, plastic pipes for sub-surface drainage system	1
4.	Drip irrigation concept and approaches. Plasticulture application in drip irrigation- online and drip inline, porous pipes, bi- wall technique, T tape, bubbler irrigation. Lay out and cost estimate of drip irrigation system for 1 ha area in orchard (6 x 6 m spacing) and vegetables at 1.2 x 0.4 m spacing). Repair and maintenance of drip laterals.	1
5.	Sprinkler irrigation- Over head sprinklers, mini and micro sprinklers, rain guns. Type and quality of plastics used in sprinkler irrigation. Repair of HDPE pipes.	1
6.	Importance of lining in canal, pond and water reservoir. Quality of plastic film used for lining in canal and water reservoir. Film laying technique. Care and maintenance of plastic lined ponds.	1
7.	Plastic mulching- Advantages of mulching. Types of mulch films available, selection of thickness and colour for different crops, Estimation of mulch quantity and cost for 1 ha area in case of orchards (6 x 6 m spacing) and 40 % surface covering in case of vegetables.	1
8.	Plastics in nursery raising- plastic bags, trays, pots. Their quality and cost aspects. Selection of bags, trays and pots for different type of seedlings and plants.	1
9.	Need and concept of environmental control cultivation, specifications and cost estimate of cladding material and nets used in 1008 sqm poly house approved by state govt. Care and maintenance of polythene used in environmental control.	1
10.	Agro nets. Shade percentage. Different types of shade nets used in agriculture. Quality aspects. Various components of a shade net house. Fixing of agro nets on shade net houses and its care and maintenance.	1
11.	Plastic nets for crop protection- anti insect nets, bird protection nets. Plastic fencing. Govt. subsidy on use of plastic nets.	1
12.	Innovative packaging solutions- Packaging practices for different crops, leno bags, carets, vacuum packing. Govt. support on use of plastic in packaging and transport of crop produce.	1
13.	Plastic cap covers for storage of food gain in open. Design and cost estimate of cap cover used for 100 and 1000 wheat bags.	1
14.	Use of plastics in farm equipments and machineries- sprayers, seed drill tubes and other spare parts of equipments and machineries. Plastic vermi-beds for composting animal dung and agro waste.	1
15.	Use of plastic for fodder preservation by silage film technique.	1
16.	Agencies involved in the promotion of plasticulture at national and state level. Govt. support to beneficiaries in various plasticulture applications	1

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1	Study of sub- surface drainage system model for understanding the concept of pipe drainage.	2
2	Design of 8 lac lit. capacity farm pond and estimation of plastic film required for lining.	1
3	Laying and flushing of drip laterals in field. Discharge and pressure measurement of 12 and 16 mm lateral.	2
4	Plastic mulching (2 x2 m) in fruit plants and estimation of quantity and cost of mulch for 100 plants.	2
5	Construction of low tunnels in about 30 sqm area and to observe seed germination inside and outside the tunnel.	3
6	Study of leno bags and other plastic bags for vegetable packaging and transport.	2
7	Design, installation and cost estimate of cap cover used for 200 wheat bags.	2
8	Raising of chilly nursery/ leafy vegetable under anti insect/ bird protection net.	2
9	Study of plastic vermi-bed. Evaluation of NPK of vermi compost prepared in vermi- bed and of FYM.	2
10	Visit to a nearby PVC pipe manufacturing unit/dealer/ farmer' s field to learn PVC pipe specifications for conveyance line, joining of PVC pipes and to learn about different PVC fittings.	4
11	Visit to a nearby sprinkler manufacturing unit/ dealer to learn about HDPE pipe specifications, fitting of sprinkler pipes and their repair.	3
12	Visit to a nearby fodder preservation site.	2
13	Visit to a nearby poly house for estimating quantity of cladding material and cost calculation and measuring inside and outside temperature and humidity.	3
14	Visit to a nearby shade net house to work out shade net requirement and cost calculation and measuring inside and outside temperature and humidity.	2

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2. Green House Management. A Training Manual of International Horticulture Innovation and Training Centre, Durgapura, Jaipur
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PBG 4412 Tissue Culture and Micro Propagation Techniques 3 (1+2)

Theory:

Setting up of commercial micro propagation unit - Lab and hardening unit design, Equipment, lab wares and consumables, Energy requirement and use of alternate energy sources. Man power requirement, Biosafety measures and waste disposal, Legislative requirement and govt. incentive. Major techniques in micro propagation- Axillary enhancement, Automated somatic embryogenesis systems, Synthetic seeds, Hardening procedures, Sterilization procedure and clean air environment, Risk factor analysis, Handling of contamination, Packaging and transportation, Marketing and Supply chain management, Economics of micropropagation, Material procurement, Stores handling, Cost reduction during production and hardening. GMP and HACCP requirement. Visit to commercial production units and case studies.

Practical:

Lab and hardening unit design. Familiarity with equipments, lab wares and consumables. Procedures of autoclaving, Media preparation Explant preparation, Surface sterilization, Axillary bud, nodal explant culture, experiments to induce somatic embryos. Preparation of synthetic seeds, Experiments for hardening of in vitro explants. Visit to commercial Production units and case studies.

Lecture schedule: Theory:

S.No.	Topic	No. of lectures
1.	Setting up of commercial Micropropagation unit	

	a. Energy requirement and use of alternative energy resources b. Biosafety measures and waste disposal. c. Legislative requirement and Govt incentive	3
2.	Major techniques in Micropropagation a. Axillary enhancement b. Automated Somatic embryogenesis system	2
3.	Risk factor analysis Handling of contamination	2
4.	Packaging and transportation	1
5.	Marketing & Supply chain management	2
6.	Economics of Micropropagation a. Material procurement b. Stores handling c. Cost reduction during production & hardening	4
7.	GMP and HACCP requirement	2

Lecture schedule: Practical:

S.No.	Topic	No. of lectures
1.	Setting up of commercial Micropropagation unit a. Lab and hardening unit design b. Equipments, lab wares and consumables c. Man power requirement d. Biosafety measures and waste disposal	6
2.	Major techniques in Micropropagation a. Axillary enhancement b. Automated Somatic embryogenesis system c. Synthetic seeds d. Hardening Procedures e. Sterilization procedures and Clean air environment	19
3.	Risk factor analysis Handling of contamination	2
4.	Visit to commercial Production units and case studies	5

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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
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PPATH 4411 Bioagents and Integrated Disease Management 3(1+2)

Theory:

Introduction, definition and concepts of Integrated Disease Management. Components of IDM- physical, chemical, cultural, biocontrol, resistance and legislative methods. Different biocontrol agents-*Trichoderma*, *Pseudomonas* and *Bacillus*. Mass production of bioagents. Mechanism of action of biocontrol agents. Methods of application of bioagents. IDM in important crops - rice, wheat, cotton, rapeseed and mustard, chickpea, groundnut and potato.

Practical:

Preparation of culture media for fungi and bacteria. Isolation and purification of antagonistic fungi and bacteria from rhizosphere soil. *In vitro* evaluation of antagonism against pathogens. Mass multiplication of bioagents (*Trichoderma*, *Pseudomonas*, *Bacillus* spp.) in different liquid and solid media. Evaluation of fungitoxicity against pathogens. Bioefficacy of antagonists against important pathogens. Visit to biopestcide production units.

Lecture schedule: Theory

S. No	Topic	No. of lectures
1.	Introduction, definition and concepts of Integrated Disease Management.	1
2.	Components of IDM- physical, chemical, cultural, biocontrol, resistance and legislative	2

	methods.	
3.	Different biocontrol agents-*Trichoderma*, *Pseudomonas* and *Bacillus*.	2
4.	Mass production of bioagents.	2
5.	Mechanism of action of biocontrol agents.	1
6.	Methods of application of bioagents.	1
7.	IDM in important crops - rice, wheat, cotton, rapeseed and mustard, chickpea, groundnut and potato.	7

Lecture schedule: Practical

S.No	Topic	No. of lectures
1.	Preparation of culture media for fungi.	2
2.	Preparation of culture media for bacteria.	2
3.	Isolation and purification of antagonistic fungi from rhizosphere soil.	4
4.	Isolation and purification of antagonistic bacteria from rhizosphere soil.	4
5.	*In vitro* evaluation of antagonism against pathogens.	4
6.	Mass multiplication of bioagents (*Trichoderma*, *Pseudomonas*, *Bacillus* spp.) in different liquid and solid media.	8
7.	Evaluation of fungitoxicity against pathogens.	2
8.	Bioefficacy of antagonists against important pathogens.	4
9.	Visit to biopestcide production units.	2

References

1. Campbell, R. 1989. Biological Control of Microbial Plant Pathogens. Cambridge Univ. Press, Cambridge.
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3. Gupta, V.K. and Sharma, R.C. (Eds.). 1995. Integrated Disease Management and Plant Health. Scientific Publ., Jodhpur.
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5. Mukherjee, K.G., Tewari J.P., Arora, D.K. and Saxena, G. 1992. Recent Developments in Biocontrol of Plant Diseases. Aditya Books, New Delhi.
6. Nene, Y.L. and Thapliyal, P.N. 1993. Fungicides in Plant Disease Control. 3rd Ed., Oxford & IBH, New Delhi.
7. Singh, R.S. (2000). Plant Disease Management. Oxford and IBH, NewDelhi.

PPATH 4412 Detection and Management of Seed-borne Pathogens 3(1+2)

Theory

Importance of seed-borne pathogens. A brief account of seed-borne fungal, bacterial and viral pathogens. Seed transmission. Paths of infection – ovule, embryo, endosperm, seed-coat & pericarp infection and seed contamination. Seed health testing methods. Management of seed-borne pathogens- physical, cultural, chemical and biological methods. Quarantine laws and procedures for seed certification. Pest risk analysis.

Practical:

Inspection of dry seeds. Detection of seed-borne pathogens by Seed-Washing Test, Seedling-Symptom Test, Blotter Method and Agar Plate Method. Embryo-Count Method. Molecular techniques for detection of seed-borne pathogens (ELISA & PCR). Identification of common seed-borne fungi – *Alternaria, Colletotrichum, Drechslera, Fusarium* etc. under microscope. Effect of chemical and biological seed treatments on seed-borne pathogens.

Lecture schedule: Theory-

S No.	Topic	No. of lectures
1	Importance of seed-borne pathogens.	1
2	A brief account of seed-borne fungal, bacterial and viral pathogens.	2

3	Seed transmission.	2
4	Paths of infection – ovule, embryo, endosperm, seed-coat & pericarp infection and seed contamination.	3
5	Seed health testing methods.	3
6	Management of seed-borne pathogens- physical, cultural, chemical and biological methods.	3
7	Quarantine laws and procedures for seed certification.	1
8	Pest risk analysis.	1

Lecture schedule: Practical-

S No.	Topic	No. of lectures
1	Inspection of dry seeds.	1
2	Detection of seed-borne pathogens by Seed-Washing Test.	2
3	Seedling-Symptom Test.	2
4	Detection of seed-borne pathogens by Blotter Method	5
5	Detection of seed-borne pathogens by Agar Plate Method	5
7	Embryo-Count Method.	3
8	Molecular techniques for detection of seed-borne pathogens (ELISA & PCR).	4
9	Identification of common seed-borne fungi – *Alternaria, Colletotrichum, Drechslera, Fusarium* etc. under microscope.	4
10	Effect of chemical and biological seed treatments on seed-borne pathogens.	4
11	Inspection of seed crops in the fields.	2

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ENTO 4411 Non-Insect Pests and Their Management 3 (1+2)

Theory:

Rodents: Rodent pests of agricultural importance. Field and storage losses due to rodents. Taxonomy, distribution, habitat behavior, burrowing pattern and breeding potential. Methods of rodent management in field and godowns- mechanical, physical, biological, chemical (rodenticides, fumigants etc.). Bait shyness and bait preference,. Other methods- sanitation, rodent proof structures, electromagnetic repellents etc. **Agricultural Ornithology:** Important phytophagous bird species in India, potential losses, host range, feeding behaviour and management. **Snails and Slugs:** Important species of agricultural importance. **Mammal pests:** Major mammals of agricultural importance, nature of damage and management. **Phytophagous mites:** General morphology and biology. Important species of mites of Agricultural importance *(Petrobia latens, Larvacarus transitans, Eutetranychus orientalis* and *Tetranychus cinnabarinus),* nature and extent of damage and their management.

Practical:

Identification of important rodent species in different habitats. Burrow patterns and feeding habits of important rodent species. Assessment and monitoring rodent pest population.Study of rodenticides Study of mechanical method of rodent control Pre-baiting, baiting and their application. Fumigation of burrows. Rodent management in field crops, threshing floors and godowns. Placement of baits, evaluation and efficacy of baits.Organization of rodent control campaigns. Identification and food habits of birds associated with agricultural crops. Crop protection measures for birds: traditional and modern methods. Study of external morphology of phytophagous mite species. Diagnostic study of symptoms caused by different groups of mites

on different crops. Study of different acaricides. Study of major mammalian pests.Study of snails and slugs.Visit to zoological museum.

Lecture Schedule: Theory

S.No.	Topic	No. of Lectures
1.	Rodent pests of agricultural importance.	1
2	Field and storage losses due to rodents.	1
3	Taxonomy, distribution, habitat behavior, burrowing pattern and breeding potential of rodents.	2
4	Methods of rodent management in field and godowns- mechanical, physical, biological, chemical (rodenticides, fumigants etc.).	2
5	Bait preparation, bait shyness and bait preference.	1
6	Other methods- sanitation, rodent proof structures, electromagnetic repellents etc.	1
7	Important phytophagous bird species in India, potential losses, host range, feeding behaviour and management.	2
8.	Important species snails and slugs of agricultural importance, nature of damage and management.	2
9.	Important mammals of agricultural importance (bats, monkeys and blue bulls), nature of damage and management.	1
10.	General morphology and biology of mite.	1
11.	Important mite species of Agricultural importance *(Petrobia latens, Larvacarus transitans, Eutetranychus orientalis* and *Tetranychus cinnabarinus),* nature and extent of damage and their management.	2

Lecture Schedule: Practical

S.No	Topic	No. of Lectures
1.	Identification of important rodent species in different habitats.	2
2.	Burrow patterns and feeding habits of important rodent species.	2
3.	Assessment and monitoring rodent pest population.	2
4.	Study of rodenticides	1
5.	Study of mechanical method of rodent control	1
6.	Pre-baiting, baiting and their application	2
7.	Fumigation of burrows.	2
8.	Rodent management in field crops, threshing floors and godowns.	2
9	Placement of baits, evaluation and efficacy of baits	2
10.	Organization of rodent control campaigns.	2
11.	Identification and food habits of birds associated with agricultural crops.	2
12.	Crop protection measures for birds: traditional and modern methods.	2
13.	Study of external morphology of phytophagous mite species.	2
14.	Diagnostic study of symptoms caused by different groups of mites on different crops.	2
15.	Study of different acaricides.	1
16.	Study of major mammalian pests.	2
17.	Study of snails and slugs.	1
18.	Visit to zoological museum.	2

References:

1. Barnes, Edwin, H.1981.The birds of India: A guide to Indian Ornithology, Cosmo publication, New Delhi.
2. Bhargava, M.C. and Kumawat, K.C. 2010. Pests of stored grains and their management, New India Publishing Agency, New Delhi.
3. Iswar Prakash, 1992. Rodents in Indian Agriculture, Vol. 1. Scientific Publishers, Jodhpur.

ENTO 4412 Biocontrol Agents and Biopesticides 3 (1+2)

Theory:

Definition, concept and principles of biological control. Attributes of an effective natural enemies. Types of natural enemies- Parasitoids and predators. Techniques of biological control. Microbial control- Pathogenicity, virulence and factors that enhance the use of microorganisms. Classification, mode of action and uses of

microbial agents, factors influencing their effectiveness. Advantages and limitations of biological control in IPM. Role of biological control in IPM. Mass production and multiplication of biocontrol agents- viruses, bacteria, fungi and parasitoids and predators and their application techniques. Potential of plant products in IPM. **Practical:**

Handling, maintenance and upkeep of equipments related to biological control. Identification of important biological agents. Mass rearing techniques of important host insects of parasitoids (one field and one storage Lepidopteran pest).Mass rearing techniques and inundative release of important parasitoids- *Trichogramma* sp./ *Campoletis chlorideae.* Mass rearing technique of important predators- Lady bird beetle and green lacewing.Collection and preservation of bio-agents. Mass production of NPV, Bt and *Metarrhizium anisopliae.* Field visit to study the behavior of natural enemies and their collection. Visits of mass production and biological control centers of national repute. Preparation of neem seed kernel extract.

Lecture Schedule: Theory

S.No.	Topic	Lectures
1.	Definition, concept and principles of biological control.	1
2.	Attributes of an effective natural enemies.	1
3.	Types of natural enemies- Parasitoids and predators.	1
4.	Techniques of biological control.	1
5.	Classification of microbial agents, mode of action and their use in pest management	2
6.	Pathogenicity, virulence and factors influencing the effectiveness of microorganisms	1
7.	Advantages and limitations of biological control in IPM.	1
8.	Role of biological control in IPM of rice, cotton, sugarcane and tomato.	2
9.	Mass multiplication of biocontrol agents- parasitoids (*Trichogramma* sp. and *Campoletis chloridae*) and predators (ladybird beetle and *Chrysoperla carnea*).	3
10.	Mass production of microbial agents- viruses, bacteria and fungi.	2
11.	Potential of plant products in IPM	1

Lecture Schedule: Practical:

S.No.	Topic	Lectures
1.	Handling, maintenance and upkeep of equipments related to biological control.	2
2.	Identification of important biological agents	2
3.	Mass rearing techniques of important host insects of parasitoids (one field and one storage Lepidopteran pest)	5
4.	Mass rearing techniques and inundative release of important parasitoids- *Trichogramma* sp./ *Campoletis chlorideae*	4
5.	Mass rearing technique of important predators- Lady bird beetle and green lacewing.	4
6.	Collection and preservation of bio-agents.	2
7.	Mass production of NPV, Bt and *Metarrhizium anisopliae.*	6
8.	Field visit to study the behaviour of natural enemies and their collection.	4
9.	Visits of mass production and biological control centres of national repute.	2
10.	Preparation of neem seed kernel extract.	1

References:

DeBach,P. 1974. Biological control by Natural enemies. Cambridge University Press.

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HORT 4411 Nursery Management of Horticultural Crops 3(1+2)

Theory:

Present status and future scope of nurseries. Recent trends in planning and layout of nurseries and progeny orchard. Principles and methods of propagation by seed, specialized vegetative structures, cutting, layering, grafting, budding and in vitro propagation. Use of PGRs in plant propagation. Propagation structures Economics of raising nursery. Nursery regulation certification.

Practical:

Identification of propagation material and equipment. Layout of nurseries and management of progeny orchard. Use of protrays and root trainers in vegetable nursery. Raising and maintenance of root stock. Multiplication of plants by sexual methods. Raising of seedlings. Propagation by cuttings in Horticultural crops. Propagation by budding in Horticultural crops. Propagation by grafting in Horticultural crops. Use of plant growth regulators in propagation. Potting, repotting or lifting of saplings (packaging) for transportation. Use of propagation media. Tetrazolium salt test for determining germination. Visit of commercial nurseries. Project preparation for nursery. Procurement of inputs. Techniques of environment management for large scale production. Care of nursery plant and management of insect, pest and diseases. Visit to commercial orchard and diagnosis of maladies.

Lecture schedule- Theory:

S.No.	Topic	No. of lectures
1.	Present status and future scope of nurseries	2
2.	Recent trends in planning and layout of nurseries and.	1
3.	Principles and methods of propagation by seed	1
4.	Progeny orchard	1
5.	Cutting,	2
6.	Layering,	1
7.	Grafting,	1
8.	Budding and in vitro propagation	2
9.	Use of PGRs in plant propagation	1
10.	Propagation structures	2
11	Economics of raising nursery	1
12	Nursery regulation certification.	1

Lecture schedule-Practical

S.No.	Topic	No. of lectures
1.	Identification of propagation material and equipment	2
2.	Layout of nurseries	1
3.	Management of progeny orchard.	2
4.	Use of protrays and root trainers in vegetable nursery	1
5.	Raising and maintenance of root stock	1
6.	Multiplication of plants by sexual methods	1
7.	Raising of seedlings	2
8.	Propagation by cuttings in Horticultural crops	2
9.	Propagation by budding in Horticultural crops	2
10.	Propagation by grafting in Horticultural crops	2
11.	Use of plant growth regulators in propagation	1
12.	Potting, repotting or lifting of saplings (packaging) for transportation	2
13.	Use of propagation media	1
14.	Tetrazolium salt test for determining germination	1
15.	Visit of commercial nurseries	3
16.	Project preparation for nursery.	1
17.	Procurement of inputs	1
18.	Techniques of environment management for large scale production	2

19.	Care of nursery plant and management of insect, pest	1
20.	Care of nursery plant and management of diseases.	1
21.	Visit to commercial orchard and diagnosis of maladies.	2

References:

1. Bose, T.K. Mitra, SK and Sandhu MK (1986). Propagation of tropical & sub-tropical horticultural crops, Naya Prakash, Calcutta.
2. Hartman, HT and Kester, DE (1986). Plant propagation principles and practices. Prentice Hall of India Pvt. Ltd., Bombay
3. Gill, SS. Bal, JS and Sadhu, AS (1985). Raising Fruit Nursery, Kalyani Publishers, New Delhi.

HORT 4412 Commercial Vegetable Production 3(1+2)

Theory:

Importance, scope and export potential of commercial vegetables in India. Importance , origin, history, area, distribution, taxonomy, recent trends of the commercial vegetables. F1-hybrids, commercialvarieties, nutritional requirement, irrigation, inter-cultural operations, weed control, mulching, plant protection of important commercial vegetables, solanaceous, okra, bulb crops, cucurbits, cowpea, amaranthus and clusterbean. Off season cultivation of important commercial vegetables . Organic vegetable production..

Practical:

Identification and botanical description of important commercial vegetables, their varieties & seeds. Estimation of viability and germinatin percentage and real value of seeds. Practice of emasculation, selfing and crossing in various vegetable crops. Seed production in root crops, cauliflower, onion, tomato and cucurbits. Planting of roots of radish, carrot and turnip for seed production. Preparation of cropping scheme for commercial vegetable growers/farms. Preparation of nursery beds, seed treatment and sowing of seeds in beds. Sowing of seeds in polythene bags/ pro-trays. Seedling preparation in pro-trays and management in Net house. Transplanting of seedlings, sowing of cucurbits in field. Growing of vegetables with drip irrigation methods. Use of plastic mulch in vegetable production. Application of manures and fertilizers, liquid fertilizers and nutrient spray in vegetable crops. Inter-cultural operations in vegetable crops. Spray of pesticides, fungicides and use of PGRs. Study of physiological disorders in vegetables. Study of maturity standards and harvesting. Seed extraction techniques, pre cooling, washing, grading, packaging and storage of vegetable crops. Calculation of cost of production and B/C ratio. Identification of major pests, diseases and disorders. Study of storage techniques of vegetable crops.

Lecture schedule- Theory:

S.No.	Topic	No. of lectures
1.	Importance, scope and export potential of commercial vegetables in India.	2
2.	Importance , origin, history, area, distribution, taxonomy, recent trends of the commercial vegetables. F1-hybrids, commercialvarieties, nutritional requirement, irrigation, inter-cultural operations, weed control, mulching, plant protection of important commercial vegetables,..	4
3.	Solanaceous, okra,	2
4.	Bulb crops,	1
5.	Cucurbits,	2
6.	Cowpea, amaranthus	1
7.	Clusterbean.	1
8.	Off season cultivation of important commercial vegetables .	2
9.	Organic vegetable production	1

Lecture schedule-Practical

S.No.	Topic	No. of lectures
1	Identification and botanical description of important commercial vegetables, their varieties & seeds.	2

2	Estimation of viability and germinatin percentage and real value of seeds.	2
3	Practice of emasculation, selfing and crossing in various vegetable crops.	2
4	Seed production in root crops, cauliflower, onion, tomato and cucurbits.	2
5	Planting of roots of radish, carrot and turnip for seed production.	1
6	Preparation of cropping scheme for commercial vegetable growers/farms.	2
7	Preparation of nursery beds, seed treatment and sowing of seeds in beds.	2
8	Sowing of seeds in polythene bags/ pro-trays. Seedling preparation in pro-trays and management in Net house.	2
9	Transplanting of seedlings, sowing of cucurbits in field.	2
10	Growing of vegetables with drip irrigation methods. Use of plastic mulch in vegetable production..	2
11	Application of manures and fertilizers, liquid fertilizers and nutrient spray in vegetable crops.	2
12	Inter-cultural operations in vegetable crops.	2
13	Spray of pesticides, fungicides and use of PGRs.	2
14	Study of physiological disorders in vegetables.	2
15	Study of maturity standards and harvesting.	1
16	Seed extraction techniques, pre cooling, washing, grading, packaging and storage of vegetable crops.	2
17	Calculation of cost of production and B/C ratio. Identification of major pests, diseases and disorders. Study of storage techniques of vegetable crops	2

References:

Chadha, K.L. and Kaloo, G Advances in Horticulture. Vol 5 & 6, Vegetable Crops. Malhotra Publishing House, New Delhi.

Choudhary, B. 1996. Vegetables, NBT, New Delhi.

Bose, T.K., Kabir, I., Maity, T.K., Parthasarthy, V.A. and Sons, M.G. 2006. Vegetable crops. Vol I, II and III.

Singh, S.P. 1989. Production technology of vegetable crops. Agril. Resesearch, Communication Centre, Karnal.

HORT 4413 Commercial Fruit Production 3(1+2)

Theory:

Importance, present position and scope of fruit production. Classification, systematic study of fruits, Importance, origin, history, area, distribution and recent trends in the production technology of commercial fruit crops *viz.* Guava, Citrus, Mango, Beal, Ber, Aonla, Lehsua, Pomegranate, Papaya, Grapes and Date palm.

Practical:

Identification of important sub tropical and tropical fruits. Lay out of orchards. Different types of planting methods including high density planting and meadow orcharding. Preparation of soil mixture for nursery bed. Identification and uses of horticultural tools. Raising of rootstock. Practices on stratification and scarification of fruit seeds. Soil sterilization of nursery. Irrigation methods of fruits orchards with the emphasis on micro irrigation. Methods of fertilizer application of fruit crops and fertigation. Use of PGRs in fruit crops. Various methods of plant protection. Vegetative methods of propagation. Demonstration of different training methods. Demonstration of different pruning methods. Methods of moisture conservation and weed control in various fruit crops. Study of physiological disorders of fruit crops. Study of nutrient deficiency symptoms of fruit crops. Study of maturity indices of fruit crops. Calculation of water or irrigation requirement of fruit crops based on CPE. Visit to different fruit orchards of local region. Cost of cultivation of ber, Aonla, mango, kinnow, papaya etc. Pollination in date palm.

Lecture schedule- Theory:

S.No.	Topic	No. of lectures
1.	Importance, present position and scope of fruit production	2
2.	Classification, systematic study of fruits,	1
Importance, origin, history, area, distribution and recent trends in the production technology of commercial fruit crops *viz.*		

3.	Guava	1
4.	Citrus	2
5.	Mango	2
6.	Beal	1
7.	Ber	1
8.	Aonla	1
9.	Lehsua	1
10.	Pomegranate,	1
11	Papaya,	1
12	Grapes	1
13	Date palm.	1

Lecture schedule-Practical:

S.No.	Topic	No. of lectures
1.	Identification of important sub tropical and tropical fruits	1
2.	Lay out of orchards	1
3.	Different types of planting methods including high density planting and meadow orcharding	2
4.	Preparation of soil mixture for nursery bed	1
5.	Identification and uses of horticultural tools	1
6.	Raising of rootstock	1
7.	Practices on stratification and scarification of fruit seeds	1
8.	Soil sterilization of nursery	2
9.	Irrigation methods of fruits orchards with the emphasis on micro irrigation	2
10.	Methods of fertilizer application of fruit crops and fertigation	2
11.	Use of PGRs in fruit crops	1
12.	Various methods of plant protection	2
13.	Vegetative methods of propagation	1
14.	Demonstration of different training methods	1
15.	Demonstration of different pruning methods.	2
16.	Methods of moisture conservation	1
17.	Weed control in various fruit crops	1
18.	Study of physiological disorders of fruit crops	1
19.	Study of nutrient deficiency symptoms of fruit crops	1
20.	Study of maturity indices of fruit crops	1
21.	Calculation of water or irrigation requirement of fruit crops based on CPE	1
22.	Visit to different fruit orchards of local region	2
23.	Cost of cultivation of ber, Aonla, mango, kinnow, papaya etc	2
24.	Pollination in date palm.	1

References:

1. Bal, J.S. 1997. Fruit Growing. Kalyani Publishers. New Delhi.
2. Bose, T.K., Mitra, S.K. and Rathore, D.S. (Eds.). 1988. Temperate Fruits- Horticulture. Allied Publication.
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AGECON 4411 Marketing Management

Theory:

Marketing Management: Meaning, definitions, marketing, Mix, market segmentation, targeting & positioning, market information system, market orgaiation and control. 4P's of marketing, product life cycle. Marketing potential : Classification of products, new product development, product line, product mix, branding, packaging and labeling. Factors affecting on prices: Pricing policies, strategies and pricing methods. Types of distribution channels. Functions of channels, members and channel management decisions.

Practical :

Performance analysis of regulated market and Marketing societies. Price spread and Marketing efficiency analysis.

Lecture Schedule- Theory

S.No.	Topic	No. of lectures
1.	Marketing Management-Meaning, Definition.	1
2.	Marketing Mix	2
3.	Market Segmentation	2
4.	Market targeting and positioning	2
5.	Market Information system	2
6.	Marketing Organization and control	
7.	4 P'S of marketing	1
8.	Product life cycle	2
9.	Classification of products	1
10.	New product Development	2
11.	Product line and product mix	2
12.	Branding, Packaging and Labeling	2
13.	Factors affecting on price and pricing policies	2
14.	Pricing strategies and pricing methods	3
15.	Types of Distribution Channels	1
16.	Functions of channel and channel management decision	3

Lecture schedule: Practical

S.No.	Topic	No. of lectures
1.	Workout the Seasonal Index of Production of Important crop based on Secondary	2
2.	Establishment the relationship between MSP and WSP of important product based on	2
3.	Study the organizational structure of various market organizations.	1
4.	Study the Departmental structure of various products.	1
5.	Analysis of profit-value of the products	1
6.	Study the key factors of decisions about profit ability of the product	1
7.	Study the comparative statement of profitability of Different products	2
8.	Study the various Channels involved in the marketing of important products.	1
9.	Study the cost Structures. Margin and price spread value added products	2
10.	Study the steps involved in designing market channel.	1
11.	Study the Structures of the Marketing Mix.	1

Reference: :

1. Marketing Management : V.S. Ramaswamy, S. Namakumari-Macmillian publishers India Ltd.
2. Marketing Management : Kotler P. 2002 Analysis planning, implementation and control, Pearson Edu.
3. Marketing Management : Saxena, M.C. GrawHill
4. Fundamentals of Marketing : Stanton W.J. Etzal MJ & Walker B.J. Mc GrawHill

AGECON 4412 Project Formulation, Evaluation and Monitoring 3(1+2)

Theory:

Introduction to project: Meaning and definition, purpose, characteristics of a project, type of agriculture projects. Project cycle: Identification, formulation, appraisal, implementation, monitoring and evaluation. Project feasibility: Market feasibility, technical feasibility, financial and economic feasibility. Project appraisal techniques: Discounted and undiscounted techniques, compounding, payback period, annual return on investment, proceeds per unit of outlay, NPW, B-C ratio, IPR, profitability index, sensitivity analysis. Project monitoring and evaluation: Ex-ante evaluation, mid course evaluation and ex-post evaluation.

Practical:

Numerical exercises on techniques of project appraisals

Lecture schedule-Theory

S.No.	Topic	No. of lectures
1.	Meaning and Definition of Project	1
2.	Purpose and Characteristics of a project	1
3.	Types of Agricultural projects	2
4.	Project cycle: Identification, formulation, monitoring and evaluation	4
5.	Project Feasibility: Market feasibility, technical feasibility, financial and economic feasibility	4
6.	Project appraisal techniques :(i). Discounted and Undiscounted techniques, Compounding,(ii). Payback period, annual returns on investment, proceeds per unit of outlay, (iii). NPW, B-C Ratio, IRR.(iv) Profitability index and sensitivity analysis.	2
7.	Project monitoring and evaluation. Ex- anti evaluation mid course evaluation and expect evaluation	2

Lecture schedule-Practical

S.No.	Topic	No. of lectures
1.	Workout the net present worth.	3
2.	Workout the net cost ratio.	3
3.	Workout the payback period.	2
4.	Calculate the breakeven point.	3
5.	Calculate the average ratio of the returns of the projects.	2
6.	Calculate the standard deviation for selection of the projects.	3
7.	Estimate of IRR of the projects.	2
8.	Calculate the benefit cost ratio of various projects.	3
9.	Analyze the comparative performance of the profitability of various projects.	3
10.	Prepare the profitability index of the projects.	2
11.	Workout the sensitivity analysis of the projects.	3
12.	Estimate the compounding and discounting value of the projects.	3

References:

1. Agriculture finance and management : S. Subba Reddy & P. raghu Ram
2. Project management : P. Chandra, Tata MC GrawHill
3. Project management: Gopal Krishan & Nagarajan K.
4. Economic analysis of Agricultural Project: Gittinger J.P. The Johons Hoplkins Univ. Press

AGECON 4413 Natural Resource Economics and Management 3 (2+1)

Theory:

Concept, Subject matter and importance of natural resource economics, Classifications of natural resources and basic terms and concepts of natural resource economics: ecology-ecosystem, biomass, biosphere, reserves, environment, pollution, etc. Natural resources management and conservation, issues in natural resources and management. Approaches to natural resource problems. Important issues in economics and management of

land, water and forest resource and the environment. Factors mitigating natural resources scarcity. Natural resources administration and policy formulations. International environmental issues, climate change.

Practical:

Environmental impact assessment. Visit to pollution control board. Optimum harvest of forestry/fishery, exercise on pollution abatement.

Lecture Schedule: Theory

S.No.	Topic	No. of Lectures
1.	Concept, subject matter and Importance of natural resource economics	2
2.	Classification of natural resources and basic terms used in natural resources	3
3.	Natural resources management and conservation	3
4.	Issues in natural resources and management	3
5.	Approaches to natural resource problems	2
6.	Important issues in economics and management to land, water and forest resources and the environment	4
7.	Factors mitigating natural resources scarcity	3
8.	Natural resources administration and policy formation	3
9.	International environment issues	3
10.	Climate change	6

Lecture schedule-Practical

S.No.	Topic	No. of lectures
1.	Study the impact of water pollution on crop production .	2
2.	Analyze the environmental pollution on land degradation.	2
3.	Study the climate change on productivity.	2
4.	Analyze the cost benefit of various pollution control programmes.	2
5.	Study the economic analyze of national disaster.	2
6.	Economic analysis of non conventional sources of energy.	3
7.	Assessment of government programmes control the pollution.	3

References;

1. Environmental and natural resource economics: Theory, policy and the sustainable society: M.E. Sharpe, Armonk NY
2. The economics of natural resource use : Hartiwick JM and Olewiler ND
3. natural resource economics : Theory and applications in India- Korr JM, Marothia D.K., Katar Singh, Ramaswamy C. and Bentley WR.
4. Environmental and natural resource economics : Tietonberg T. s

STAT 4411 Sampling Techniques 3(1+2)

Theory:

Sampling unit. Sampling frame, Principles of sample survey. main steps in survey, types of sampling, advantages of sampling over census, limitations of sampling; Sources and types of non-sampling errors, biases and variance error, non-sampling bias, non-coverage, incomplete frames and missing units; Simple random sampling with and without replacement. Stratified sampling. Systematic sampling; Cluster sampling, multi-stage sampling. Basic idea about ratio and regression estimators. NOTE : Mathematical derivations and proofs are excluded.

Practical:

Random sampling - use of random number tables. Determination of sample size, estimation of mean and variance of simple random sampling with and without replacement, stratified random sampling. Cluster sampling, two stage sampling, Ratio and Regression estimators, Efficiency of SRSWR over SRSWOR,. Estimation of gain in precision due to stratification. Relative efficiency of cluster sampling equal cluster over unequal cluster.

Lecture Schedule: Theory

S. No.	Topic	No. of Lectures
1.	Sampling unit. Sampling frame	1
2.	Principles of sample survey. main steps in survey	2
3.	Types of sampling	1
4.	Advantages of sampling over census, limitations of sampling	1
5.	Sources and types of non-sampling errors	1
6.	Biases and variance error	1
7.	Non-sampling bias, non-coverage, incomplete frames and missing units	1
8.	Simple random sampling with and without replacement	2
9.	Stratified sampling	1
10.	Systematic sampling	1
11.	Cluster sampling	1
12.	Multi-stage sampling	1
13.	Basic idea about ratio and regression estimators.	2

Lecture Schedule: Practical

S. No.	Topic	No. of Lectures
1.	Random sampling - use of random number tables.	2
2.	Determination of sample size	2
3.	Estimation of mean and variance of simple random sampling with and without replacement	6
4.	Stratified random sampling	4
5.	Cluster sampling,	3
6.	Two stage sampling	3
7.	Ratio and Regression estimators	3
8.	Efficiency of SRSWR over SRSWOR	3
9.	Estimation of gain in precision due to stratification.	3
10.	Relative efficiency of cluster Sampling equal cluster over unequal cluster.	3

References:

1. Cochran, W.G. 1977. Sampling Techniques, John Wiley.
2. Murthy, M.N. 1977. Sampling Theory and Methods. 2"' Ed, statistical Publ.
3. Singh, D. Singh, P. and Kumar, P. 1982. Handbook on Sampling Methods, IASRI Publ.
4. Sukhatme , S.V. and Ashok. C. 1984. Sampling Theory of Surveys with Applications. Iowa State university Press and Indian Society of Agricultural Statistics. New Delhi.

EXTED 4411 Visuals & Graphic Communication 3(1+2)

Theory:

Role of visuals & graphics in Communication. Characteristics of visuals &graphics. Functions of visuals and graphics. Classification and selection of visuals. Designing message for visuals and Graphics. Principles and production of low cost visuals like charts, posters, flash cards, exhibits, photographs slides and PC based visuals. Multimedia production. Preparation and presentation of multimedia slides.Pre-testing and evaluation of visuals. Scanning of visuals.

Practicals: Preparation of low cost projected and Non-Projected visuals. Designing and layout of charts, posters, flash cards etc. Power point presentations. Generating computer aided presentation graphics. Scanning and evaluation of visuals.

Lecture Schedule: Theory

S. No.	Topic	No. of Lectures
1	Role of visuals & graphics in Communication	1
2	Characteristics of visuals &graphics	1

3	Functions of visuals and graphics	1
4	Classification and selection of visuals	2
5	Designing message for visuals and Graphics	2
6	Principles and production of low cost visuals like charts, posters, flash cards, exhibits, photographs slides and PC based visuals	5
7	Multimedia production. Preparation and presentation of multimedia slides	2
8	Pre-testing and evaluation of visuals	1
9	Scanning of visuals	1

Lecture Schedule: Practical

S.No.	Topic	No. of Lectures
1.	Preparation of low cost projected and Non-Projected visuals. Designing and layout of charts, posters, flash cards, exhibits, photographs slides and PC based visuals etc.	18
2.	Power point presentations.	4
3.	Generating computer aided presentation graphics.	4
4.	Scanning of visuals.	3
5.	Evaluation of visuals.	3

References;

1. Bhatia A. 2005. *Visual Communication*. Rajat Publications, New Delhi.
2. Edgar Dale 1970. *Audio Visual methods in Teaching*. Holt, Rinehart & Winston.
3. James WB, Richard BL, Fried F Harcleroad. 1952. *A.V. Instructional Material & Methods*. Mc.Graw Hill.
4. Reddy YN. 1998. *Audio Visual Aids in Teaching, Training and Extension*. Haritha Publ. House, Hyderabad.

EXTED 4412 Government Policies and Programmes on Agriculture 3(1+2)

Theory:

Indian situation of Agriculture at a glance. Issues and challenges in agricultural development in India. National Policy for Agricultural development since independence: Development programmes for agriculture with reference to year of start, objectives and salient features. Research, extension and teaching mechanism at national and state level with reference to agriculture, Public-Private Partnership.

Practical:

Preparation of interview schedule for conducting bench mark survey with special reference to demographic information of a nearby village. Visit of KVK / voluntary organization to study developmental activities related to agriculture. Field visit to a successful agriculture related enterprise. Study the functioning of State Department of Agriculture. Evaluation of any ongoing agricultural development programme. Social auditing of MNREGA.

.Lecture Schedule: Theory

S.No.	Topic	No. of Lectures
1	Indian situation of Agriculture at a glance.	1
2	Issues and challenges in agricultural development in India.	3
3	National Policy for Agricultural development since independence	3
4	Development programmes for agriculture with reference to year of start, objectives and salient features	5
5	Research, extension and teaching mechanism at national and state level with reference to agriculture, Public-Private Partnership.	4

Lecture Schedule: Practical

S.No.	Topic	No. of Lectures
1	Preparation of interview schedule for conducting bench mark survey with special reference to demographic information of a nearby village.	10
2	Visit of KVK / voluntary organization to study developmental activities related to agriculture.	5
3	Field visit to a successful agriculture related enterprise.	5
4	Study the functioning of State Department of Agriculture.	4
5	Evaluation of any ongoing agricultural development programme.	5
6	Social auditing of MNREGA.	3

References;

1. Subhalakshmi V. 2005. Globalization- Indian Experience. ICFAI Univ. Press, Hyderabad.
2. Bagchi J.2007. Agriculture and WTO opportunity for India.Sanskruti.
3. John KC, Sharma DK, Rajan CS and Singh C. 1997. Farmers Participation in Agricultural Research and Extension Systems. MANAGE, Concept Publi. Co.
4. Narasaiah ML. 2005. Agricultural Development and world Trade organization. Discovery Publ.
5. Dunn DD. 1978. Appropriate Technology with a Human Face. Mecmillan Press.
6. Kapoor SK, Roy PB & Roy AK. 1980. Role of Information centers in Technology Transfer. IASLIC, Kolakata.
7. Lekhi RK. 1984. Technological Revolution in Agriculture. Classical Publ. Co.
8. Ray GL.2006. Extension Communication and management. Kalayani Publ.
9. Supe SV. 2009. A Text Book of Extension Education. Agrotech Publishing Academy, Udaipur.
10. Viswanathan M. 1994. Women in Agriculture and Rural Development. Printwell Publ.

LPM 4412 Poultry Production and Management 3(1+2)

Theory:

Poultry breeds of economic importance. Formation and laying of egg. Systems of poultry rearing. Feeding and management of different categories of poultry. Common nutritional disorders of birds. Vaccination and deworming. Selection and culling of different classes of poultry. Formulation of poultry farm plan.

Practical:

Familiarity with external body parts of chicken. Handling and restraining of poultry birds. Selection of site for poultry farm. Layout of poultry farm buildings. Brooding, debeaking and vaccination of chicks. Internal structure and composition of egg. Collection, recording, grading, marketing and preservation of chicken eggs. Management of broilers. Dressing of birds. Incubation of eggs. Common feed ingredients. Feed additives used in poultry. Formulation of chick starter, grower and layer feed. Formulation of broiler starter and finisher feed. Cleaning and disinfection of poultry houses. Management of poultry farm under adverse climatic conditions. Economics of poultry farm.

Lecture schedule - Theory

S.No.	Topic	No. of lectures
1	Poultry breeds of economic importance.	2
2	Formation and laying of egg.	1
3	Different Systems of poultry rearing.	2
4	Feeding and management of different categories of poultry.	3
5	Common nutritional disorders of birds.	2
6	Vaccination in chicks	2
7	Deworming in poultry birds	1
8	Selection and culling of different classes of poultry.	2
9	Formulation of poultry farm plan.	1

Lecture schedule-Practical:

S.No.	Topic	No. of lectures
1	Familiarity with external body parts of chicken.	1
2	Handling and restraining of poultry birds.	1
3	Selection of site for poultry farm.	1
4	Layout of poultry farm buildings.	2
5	Brooding, debeaking and vaccination of chicks.	3
6	Internal structure and composition of egg.	2
7	Collection, recording, grading, marketing and preservation of chicken eggs.	3
8	Management of broilers.	2
9	Dressing of birds.	1
10	Incubation of eggs.	2
11	Common feed ingredients.	3
12	Feed additives used in poultry.	1

13	Formulation of chick starter, grower and layer feed.	3
14	Formulation of broiler starter and finisher feed.	2
15	Cleaning and disinfection of poultry houses.	2
16	Management of poultry farm under adverse climatic conditions	2
17	Economics of poultry farm	1

References:

1. Banerjee, G. C. 20011. A Text Book of Animal Husbandr. VIII ed. Oxford and IBH Publications. New Delhi.
2. ICAR. 2011. Hand Book of Animal Husbandry published by DIPA, ICAR, New Delhi.
3. Ranjan, S.K.1994. Animal Nutrition and Feeding Practices. Vikash Publications. New Delhi.
4. Singh, R A 1985. Poultry Prodution. Kalyani Publications. New Delhi
5. Sukumar, De. 2000. Outlines of dairy technology. Oxford University Press,New Delhi.
6. Thomas C.K., Sastry NSR and Singh,RA. 1982. Farm Animal Management and Poultry Pdn, Vikash.Publ.

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

VIII Semester

Rural Agricultural Work Experience (RAWE)

Programme	**Duration (Weeks) credits**
Orientation	1 (Non Credit)
Research Station/KVK/ including village attachment and *In-situ* interaction of farmers, students and research station scientists	6 (6 credits)
In-situ interaction of farmers, college faculty and students	2 (in two splits)(2 credits)
Industrial Attachment*/Skill Development/Experiential Learning Courses	8 (8 credits)
Educational Tour	2 (2 credits)
Project Report Preparation and Evaluation	1 (Non Credit)

*Industrial attachment shall include attachment with any of the following industries/Organisations

1. Seed industries/ companies
2. Fertilizer industries/companies
3. Pesticide industries/companies
4. Biotechnological industries/companies
5. Tissue culture laboratories
6. Bio-Pesticide industries
7. Commercial nurseries/land scaping units
8. Food processing units
9. Agricultural finance institutions/banks/credit societies, etc
10. NGOs