

B. Sc. (Ag) New Course

Ist Semester						
Course title	Credit	Subject code	Evaluation marks			
			T	P	I	Total
Fundamentals of Agronomy	3 (2+1)	AG-101	50	30	20	100
Fundamentals of Genetics	3 (2+1)	AG-102	50	30	20	100
Fundamentals of Plant Biochemistry and Biotechnology	3 (2+1)	AG-103	50	30	20	100
Fundamentals of Horticulture	2 (1+1)	AG-104	50	30	20	100
Fundamentals of Agricultural Extension Education	3 (2+1)	AG-105	50	30	20	100
Introduction to Forestry	2 (1+1)	AG-106	50	30	20	100
Introductory Animal Husbandry	2 (1+1)	AG-107	50	30	20	100
Comprehension & Communication Skills in English	2 (1+1)	AG-108	50	30	20	100
Agricultural Heritage	1(1+0)	AGR-1	80	00	20	100
Introductory Biology/Basic Agriculture-I	2 (1+1)	AGR-4/2	80	00	20	100
Elementary Mathematics/ Basic Agriculture-II	2 (1+1)	AGR-5/3	80	00	20	100
NSS/NCC/Physical Education & Yoga Practices	2 (0+2)	AGNG-1	00	00	100	100
TOTAL	27(15+12)					
IInd Semester						
Course title	Credit	Subject code	Evaluation marks			
			T	P	I	Total
Fundamentals of Crop Physiology	2 (1+1)	AG-201	50	30	20	100
Fundamentals of Soil Science	3 (2+1)	AG-202	50	30	20	100
Fundamentals of Entomology	4(3+1)	AG-203	50	30	20	100
Fundamentals of Agricultural Economics	2 (2+0)	AG-204	80	00	20	100
Soil and Water Conservation Engineering	2 (1+1)	AG-205	50	30	20	100
Fundamentals of Plant Pathology	4(3+1)	AG-206	50	30	20	100
Production Technology for Vegetables and Spices	2 (1+1)	AG-207	50	30	20	100
Rural Sociology & Educational Psychology	2 (2+0)	AG-208	80	00	20	100
Poultry Production & Management	2 (1+1)	AG-209	50	30	20	100
Human Values & Ethics	1(1+0)	AGNG-2	80	00	20	100
TOTAL	24(17+7)					

T- Theory,

P-Practical.

I- Internal Assessment/Mid-term Assessment

IIIrd Semester

Course title	Credit	Subject code	Evaluation marks			
			T	P	I	Total
Crop Production Technology – I (<i>Kharif</i> crops)	2 (1+1)	AG-301	50	30	20	100
Practical Crop Production - I (<i>Kharif</i> crops)	2 (0+2)	AG-302	00	00	100	100
Fundamentals of Plant Breeding	3 (2+1)	AG-303	50	30	20	100
Agricultural Microbiology	2 (1+1)	AG-304	50	30	20	100
Agricultural Finance and Co-Operation	3 (2+1)	AG-305	50	30	20	100
Farm Machinery and Power	2 (1+1)	AG-306	50	30	20	100
Principles of Integrated Disease Management	3 (2+1)	AG-307	50	30	20	100
Environmental Studies & Disaster Management	3 (2+1)	AG-308	50	30	20	100
Statistical Methods	2 (1+1)	AG-309	50	30	20	100
Dairy Science	2 (1+1)	AG-310	50	30	20	100
Management of Beneficial Insects*	2 (1+1)	AG-311	50	30	20	100
TOTAL *This course will be taught in V th semester for students of batch 2017-18.	26(14+12)					

IVth Semester

Course title	Credit	Subject code	Evaluation marks			
			T	P	I	Total
Crop Production Technology – II (<i>Rabi</i> crops)	2 (1+1)	AG-401	50	30	20	100
Practical Crop Production - II (<i>Rabi</i> crops)	2 (0+2)	AG-402	00	00	100	100
Principles of Seed Technology	3 (2+1)	AG-403	50	30	20	100
Problematic soils and their Management	2 (1+1)	AG-404	50	30	20	100
Pests of Crops and Stored Grain and their Management	3 (2+1)	AG-405	50	30	20	100
Renewable Energy and Green Technology	2 (1+1)	AG-406	50	30	20	100
Production Technology for Ornamental Crops, MAP and Landscaping	2 (1+1)	AG-407	50	30	20	100
Entrepreneurship Development and Business Communication	2 (1+1)	AG-408	50	30	20	100
Introductory Agro-meteorology & Climate Change	2 (1+1)	AG-409	50	30	20	100
Agri- Informatics	2 (1+1)	AG-410	50	30	20	100
Principles of Food Science and Nutrition	2 (1+1)	AG-411	50	30	20	100
TOTAL	24(12+12)					

T- Theory,

P-Practical.

I- Internal Assessment/Mid-term Assessment

V th Semester						
Course title	Credit	Subject code	Evaluation marks			
			T	P	I	Total
Rainfed and dryland Agriculture	2 (1+1)	AG-501	50	30	20	100
Crop Improvement-I (<i>Kharif</i> crops)	2 (1+1)	AG-502	50	30	20	100
Principles of Integrated pest management	2 (1+1)	AG-503	50	30	20	100
Agricultural Marketing Trade & Prices	3 (2+1)	AG-504	50	30	20	100
Protected Cultivation and Secondary Agriculture	2 (1+1)	AG-505	50	30	20	100
Diseases of Field and Horticultural Crops and their Management-I	3 (2+1)	AG-506	50	30	20	100
Production Technology for Fruit and Plantation Crops	2 (1+1)	AG-507	50	30	20	100
Communication Skills and Personality Development	2 (1+1)	AG-508	50	30	20	100
Intellectual Property Rights	1(1+0)	AG-609	80	00	20	100
Food Processing and Safety Issues	2 (1+1)	AG-510	50	30	20	100
Elective-I	3 (2+1)	AGEL-1	50	30	20	100
TOTAL	24(14+10)					
VI th Semester						
Course title	Credit	Subject code	Evaluation marks			
			T	P	I	Total
Farming System, Precision Farming & Sustainable Agriculture	2 (1+1)	AG-601	50	30	20	100
Principles of Organic Farming	2 (1+1)	AG-602	50	30	20	100
Crop Improvement-II (<i>Rabi</i> crops)	2 (1+1)	AG-603	50	30	20	100
Manures, Fertilizers and Soil Fertility Management	3 (2+1)	AG-604	50	30	20	100
Farm Management, Production & Resource Economics	2 (1+1)	AG-605	50	30	20	100
Geo-informatics and Nanotechnology	2 (1+1)	AG-606	50	30	20	100
Diseases of Field and Horticultural Crops and their Management-II	3 (2+1)	AG-607	50	30	20	100
Post-harvest Management and Value Addition of Fruits and Vegetables	2 (1+1)	AG-608	50	30	20	100
Watershed and Wasteland Management	2 (1+1)	AG-609	50	30	20	100
Elective-2	3 (2+1)	AGEL-2	50	30	20	100
Educational Tour	2 (1+1)	AGNG-3	50	30	20	100
TOTAL	25(14+11)					

T- Theory, P-Practical. I- Internal Assessment/Mid-term Assessment

Course AG-311 Management of Beneficial Insects will also be taught in Vth sem for students of batch 2017-18 only as it was left in IIIrd semester during 2018-19.

VII th Semester			
SN.	Rural Agricultural Work Experience and Agro-industrial Attachment (RAWE & AIA)		
	Activities	No. of weeks	Credit Hours
1	General orientation & On campus training by different faculties	1	14
2	Village attachment	8	
	Unit attachment in Un.v/ College. KVK/ Research Station. Attachment	5	
3	Plant clinic	2	02
	Agro-Industrial Attachment	3	04
4	Project Report Preparation, Presentation and Evaluation	1	
Total weeks for RAWE & AIA		20	20

Marks Distribution:

S.No	Department	Credit Hours	Title of course	Evaluation marks			
				T	P	I	Total
1	Agronomy	2(0+2)	RAWE	00	00	100	100
2	Genetics & Plant Breeding	2(0+2)		00	00	100	100
3	Soil Science & Agricultural Chemistry	2(0+2)		00	00	100	100
4	Animal Husbandry and Dairying	2(0+2)		00	00	100	100
5	Agricultural Economics	2(0+2)		00	00	100	100
6	Agricultural Engineering	2(0+2)		00	00	100	100
7	Plant Pathology	2(0+2)		00	00	100	100
8	Horticulture	2(0+2)		00	00	100	100
9	Agricultural Extension	2(0+2)		00	00	100	100
10	Soil conservation	1(0+1)		00	00	100	100
11	Entomology	1(0+1)		00	00	100	100

T- Theory,

P-Practical.

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RAWE Component –II

Agro Industrial Attachment

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

Activities and Tasks during Agro-Industrial Attachment Programme

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

VIIIth semester

Modules for Skill Development and Entrepreneurship: A student has to register 20 credits opting for two modules of (0+10) credits each (total 20 credits) from the package of modules in the VIIIth semester out of the following 12 modules .

Sr.	Title of the module	Credits
1.	Production Technology for Bio-agents and Bio-fertilizer	10(0+10)
2.	Seed Production and Technology	10(0+10)
3.	Mushroom Cultivation Technology	10(0+10)
4.	Soil, Plant, Water and Seed Testing	10(0+10)
5.	Commercial Beekeeping	10(0+10)
6.	Poultry Production Technology	10(0+10)
7.	Commercial Horticulture	10(0+10)
8.	Floriculture and Landscaping	10(0+10)
9.	Food Processing	10(0+10)
10.	Agriculture Waste Management	10(0+10)
11.	Organic Production Technology	10(0+10)
12.	Commercial Sericulture	10(0+10)

Marks Distribution:

S.No	Department	Credit Hours	Title of course	Evaluation marks			
				T	P	I	Total
1	Concern	10(0+10)	Module-I	00	00	100	100
2		10(0+10)	Module-II	00	00	100	100

Evaluation of Experiential Learning Programme/ HOT

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

Discipline-wise summary of credit hours

S.N.	Group	Credits
1.	Agronomy	17
2.	Genetics & Plant Breeding	15
3.	Soil Science & Agricultural Chemistry	13
4.	Entomology	11
5.	Agricultural Economics	10
6.	Agricultural Engineering	10
7.	Plant Pathology	13
8.	Horticulture	10
9.	Agricultural Extension	09
10.	Soil conservation	09
11.	Statistics, Computer Application and I.P.R.	05
12.	Animal Husbandry and Dairying	10
13.	English	02
14.	Remedial Courses*	05 (Bio/ Math); 05 (Agriculture)
15.	NSS/NCC/Physical Education & Yoga Practices**	2
16.	Human Values and Ethics**	1
17.	Educational Tour**	2
Total		134 + 5* + 5** + 6 credits elective =150
RAWE & ELP		20 +20
Grand Total		150+20+20=190

* Remedial courses

** Non-Gradial courses

Elective Courses : A student can offer one elective course out of the following during Vth and VIth semesters each.

S.N.	Courses	Department	Semester	Credit Hours
1.	Agribusiness Management	Ag Economics	V th semester	3(2+1)
2.	Agrochemicals	Soil Science		3(2+1)
3.	Commercial Plant Breeding	Genetics & Plant breeding		3(1+2)
4.	Landscaping	Horticulture		3(2+1)
5.	Food Safety and Standards	Animal Husbandry and Dairying		3(2+1)
6.	Protected Cultivation	Ag Engineering		3(2+1)
7.	Biopesticides & Biofertilizers	Soil Science	VI th Semester	3(2+1)
8.	Hi-tech. Horticulture	Horticulture		3(2+1)
9.	Weed Management	Agronomy		3(2+1)
10.	System Simulation and Agro-advisory	Ag Engineering		3(2+1)
11.	Agricultural Journalism	Agri Extension		3(2+1)
12.	Fish /Duck/ Quail/ Rabbit culture	Animal Husbandry & Dairying		3(2+1)

AGRONOMY

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
1	Fundamentals of Agronomy	3 (2+1)	50	20	30	I

Theory

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

Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, harvesting and threshing of crops.

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Study of soil moisture measuring devices, Measurement of irrigation water.

Related Books

1. Principles of Agronomy- T.Y. Reddy & G.H.S. Reddy, Kalyani Publishers, New Delhi.
2. Principles of Crop Production- S.R. Reddy, Kalyani Publication.
3. Fundamentals of Agronomy- Dr. K.L. Nandeha, M. Nandeha, Kushal Publishers & Distributors, Varanasi.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
2	Crop Production Technology-I (Kharif Crops)	2 (1+1)	50	20	30	III

Theory

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

Practical

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

Related Books

1. Agronomy of Field Crops- S.R. Reddy- Kalyani Publications
2. Textbook of Field Crop Production Vol -I & II by Dr. Rajendra Prasad, ICAR, Publication.
3. Modern Technique of Raising Field Crops By Chhidda Singh, Oxford & IBH Publishing Company, New Delhi.
4. Science of Crop Production (Kharif & Rabi) By G.S.Tomar, S.P.S. Tomar & S.N. Khajani, Kushal Publication and Distributors, Varanasi.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
3	Practical Crop Production-I (Kharif Crops)	2 (0+2)	00	100	00	III

Practical

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

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
4	Crop Production Technology-II (Rabi crops)	2 (1+1)	50	20	30	IV

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rape seed, mustard and sunflower; sugar crops-sugarcane; other crop-Potato. Forage crops-berseem, lucerne and oat.

Practical

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

Related Books

1. Agronomy of Field Crops- S.R. Reddy- Kalyani Publications
2. Textbook of Field Crop Production Vol –I & II by Dr. Rajendra Prasad, ICAR, Publication.
3. Modern Technique of Raising Field Crops By Chhidda Singh, Oxford & IBH Publishing Company, New Delhi.
4. Science of Crop Production (Kharif & Rabi) By G.S.Tomar, S.P.S. Tomar & S.N. Khajanji, Kushal Publication and Distributors, Varanasi.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
5	Practical Crop Production-II (Rabi Crops)	2 (0+2)	00	100	00	IV

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management

technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
6	Rainfed and Dryland Agriculture	2 (1+1)	50	20	30	V

Theory

Rainfed and dryland agriculture – Introduction, types and history. Problems & prospects of rainfed agriculture in India. Soil and climatic conditions prevalent in rainfed areas. Drought: types, effect of water deficit on physio – morphological characteristics of the plants. Mechanism of crop adoption under moisture deficit conditions. Efficient utilization of water through soil and crop management practices, management of crops in rainfed areas. Contingent crop planning for aberrant weather conditions. Precision agriculture; concepts and techniques; their issues and concerns for Indian agriculture.

Practical

Studies on climatic classifications, studies on rainfall pattern in rainfed areas of the country. Studies on cropping pattern of different dryland areas in the country and demarcation of dryland area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigations on the basis of evapo-transpiration demand of crops effective rainfall and its calculations. Visit to rainfed research stations/watersheds.

Related Books

1. Rainfed Agriculture & Watershed Management, By S.R. Reddy & G.P. Reddy, Kalyani Publications.
2. Rainfed Agriculture & Watershed Management, Dr. Rajesh Ahemed Sah, Kushal Publications, Varanasi.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
7	Farming System, Precision Farming and Sustainable Agriculture	2 (1+1)	50	20	30	VI

Theory

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Sustainable agriculture-problems and its impact on agriculture, conservation agriculture strategies, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system components of IFS and its advantages, resource use efficiency and optimization techniques, farming system and environment,

Practical

- Tools for determining productions & efficiencies in cropping and farming systems.
- Indicators of sustainability of cropping & Farming systems
- Site specific development of IFS models for different agro-climatic zones.
- Visit of IFS models in different agro climatic zones of nearby state Universities/Institutes and farmer fields.

Related Books

1. Farming system & Sustainable Agriculture, S.R. Reddy, Kalyani Publications, New Delhi.
2. Krishi Pradaliyon se sum gatisheel krishi, Dr. P.K. Singh & Dr. S.P. Vishwakarma, Rama Publishing House, Meerut.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
8	Principles of Organic Farming	2 (1+1)	50	20	30	VI

Theory

Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming.

Practical

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

Related Books

1. Principles of Organic Farming- S.R. Reddy, Kalyani Publications.
2. Basics of Organic Farming- Mamta Bansal- CBS Publication & Distributors, Pvt. Ltd., New Delhi, 011-23243014.

GENETICS AND PLANT BREEDING

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
1	Fundamentals of Genetics	3 (2+1)	50	20	30	I

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. cell division- mitosis and meiosis. Probability and Chi-square. Dominance relationships, gene interactions.

Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

Practical

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

Related Books

1. Fundamentals of Genetics- Phundan Singh, Kalyani Publihers.
2. Genetics- B.D. Singh, Kalyani Publishers.
3. Genetics and Breeding of Pulse Crops- Roshni Vijayan et al., Kalyani Publishers.
4. Genetics- P.K. Gupta, Rastogi Publications.
5. Genetics- Daniel Hartl and M. Ruvalo, Jones and Bartlett.
6. Genetics- A Molecular Approach, By Peter J. Russell, Pearson.
7. Concept of Genetics- Klug, Cummings, Spencer, Pearson.
8. Genetics- Robert I. Booker, McGraw Hill.
9. Genetics- Stricberger, M.W., PHI Learning.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
2	Fundamentals of Crop Physiology	2 (1+1)	50	20	30	II

Theory

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

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO₂ assimilation by Infra Red Gas Analyser (IRGA).

Related Books

1. Fundamentals of Genetics- Phundan Singh, Kalyani Publihers.
2. Genetics- B.D. Singh, Kalyani Publishers.
3. Genetics and Breeding of Pulse Crops- Roshni Vijayan et al., Kalyani Publishers.
4. Genetics- P.K. Gupta, Rastogi Publications.
5. Genetics- Daniel Hartl and M. Ruvalo, Jones and Bartlett.
6. Genetics- A Molecular Approach, By Peter J. Russell, Pearson.
7. Concept of Genetics- Klug, Cummings, Spencer, Pearson.
8. Genetics- Robert I. Booker, McGraw Hill.
9. Genetics- Stricberger, M.W., PHI Learning.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
3	Fundamentals of Plant Breeding	3 (2+1)	50	20	30	III

Theory

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization and Introduction; Centres of origin/diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes- Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

Practical

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregation populations. Methods of calculating mean, range, variance, standard deviation, heritability. Designs used in plant breeding experiments, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out-crossing. Prediction of performance of double cross hybrids.

Related Books

1. Breeding of Field Crops- John M. Pochlman, Springer.
2. Breeding of Field Crops- V.L. Chopra, India Book House.
3. Breeding of Field Crops- D.A. Sleper, 5th edition, Blackwell Publishing House.
4. Principles of Plant Breeding- Robert W. Allarol, 2nd Edition, Willey.
5. Principles of Plant Breeding- Z.A. Dar, P.D. Meena et al., Raj Publishing House.
6. Fundamentals of Plant Breeding- B.D. Singh & Payal Bansal, Kalyani Publishers.
7. Plant Breeding- B.D. Singh, Kalyani Publishers.
8. Plant Breeding- Jack Brown & Peter Coligari, Willey BlackWell Publishing House.
9. Principles of Genetics and Breeding- George Acquaah, Willey Publishing House.

10. Principles and Procedure of Plant Breeding- G.S. Chahal and S.S. Gosal, Alpha Science International Ltd.
11. Plant Breeding Methods- Maha Balram, PHI Learning Pvt. Ltd.
12. Marker Assisted Plant Breeding -B.D. Singh & A.K. Singh, B.Rai, Springer.
13. Principles and Practices of Heterous Breeding- B. Rai, Agro Biological Publication.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
4	Principles of Seed Technology	3 (2+1)	50	20	30	IV

Theory

Seed and seed technology: introductory, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

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

Practical

Seed production in major cereals: Wheat, Rice, Maize, Sorghum, Bajra and Ragi. Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field bean, pea. Seed production in major oilseeds: Soybean, Sunflower, Rapeseed, Groundnut and Mustard. Seed production in important vegetable crops. Seed sampling and testing: Physical purity, germination, viability, etc. Seed and seedling vigour test. Genetic purity test: Grow out test and electrophoresis. Seed certification: Procedure, Field inspection, Preparation of field inspection report. Visit to seed production farms, seed testing laboratories and seed processing plant.

Related Books

1. Seed Science and Technology- L.O. Copeland & M.F. McDonald, Springer.
2. Textbook of Seed Science and Technology- Patravathi, et al., New India Publishing Agency.
3. Textbook of Seed Science and Technology- Irfan Ali Khan, Agrotech Press.
4. Seed Science and Technology- Brijesh Tiwari, Oxford Company.
5. Seed Technology- D. Khare and M.S. Bhole, Scientific Publishers.
6. Principles of Seed Technology- Phundan Singh, Kalyani Publishers.
7. Seed Science and Technology- Sheela Verma, New Vishal Publications.
8. Seed Technology 2nd edition, R.L. Agarwal, Oxford and IBH Publishing House.
9. Principles of Seed Technology- B.L. Jana, Vishkar Publishers.
10. Seed Science and Technology-B.D. Singh and A.K. Joshi, Kalyani Publishers.
11. Seed Science and Technology- Subir Sen and Nabinananda Ghosh, Kalyani Publishers

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
5	Crop Improvement – I (<i>Kharif</i>)	2 (1+1)	50	20	30	V

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding - self pollinated, cross pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional

and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Sesame, Caster, Cotton, Cowpea, and Tobacco Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

1. Plant Breeding- Jack Brown & Peter Coligari, Willey BlackWell Publishing House.
2. Principles of Genetics and Breeding- George Acquaah, Willey Publishing House.
3. Principles and Procedure of Plant Breeding- G.S. Chahal and S.S. Gosal, Alpha Science International Ltd
4. Seed Science and Technology-B.D. Singh and A.K. Joshi, Kalyani Publishers.
5. Fundamentals of Genetics- Phundan Singh, Kalyani Publihers.
6. Genetics- B.D. Singh, Kalyani Publishers.
7. Genetics and Breeding of Pulse Crops- Roshni Vijayan et al., Kalyani Publishers.
8. Genetics- P.K. Gupta, Rastogi Publications

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
6	Crop Improvement – II (<i>Rabi</i>)	2 (1+1)	50	20	30	VI

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potat, Berseem and Sugarcane, Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops

1. Plant Breeding- Jack Brown & Peter Coligari, Willey BlackWell Publishing House.
2. Principles of Genetics and Breeding- George Acquaah, Willey Publishing House.
3. Principles and Procedure of Plant Breeding- G.S. Chahal and S.S. Gosal, Alpha Science International Ltd
4. Seed Science and Technology-B.D. Singh and A.K. Joshi, Kalyani Publishers.
5. Fundamentals of Genetics- Phundan Singh, Kalyani Publihers.
6. Genetics- B.D. Singh, Kalyani Publishers.
7. Genetics and Breeding of Pulse Crops- Roshni Vijayan et al., Kalyani Publishers.
8. Genetics- P.K. Gupta, Rastogi Publications.

SOIL SCIENCE & AGRICULTURAL CHEMISTRY

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
1	Fundamentals of Plant Biochemistry	2 (1+1)	50	20	30	I

Theory

Importance of Biochemistry, Carbohydrate: Importance and classification of Monosaccharides, Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; lipids, Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins, Enzymes: General Properties; Classification; Mechanism of action. Classification of vitamin, structure, role and its deficiency symptoms. Nucleic acids: importance and classification; Structure of Nucleotides.

Phytohormone ; Occurrence, classification, structure, functions and important plant growth substance. Alkaloids: classification , general properties of canine Nicotine and papaverine.

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose (Reducing and non-reducing sugars) / proteins. Titration methods for estimation of amino acids/lipids, paper chromatography. Estimation of vitamin C & determination of calcium by EDTA method.

Suggested Readings:-

1. Jain, J.L., Jain, Sanjay & Jain, Nitin (2007) Fundamentals of Biochemistry. S. Chand & Company Ramnagar New Delhi.
2. Bonner, J.E. (1996) Plant Biochemistry. Academic Press. Inc. New York.
3. Mc Larsen, A.D. & Peterson, G.H. (1967) Soil Biochemistry. Vol. XI, Marcel Dekker.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
2	Fundamentals of Soil Science	3 (2+1)	50	20	30	II

Theory

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

Practical :

Study of soil profile in field. Study of soil sampling tools, collection of representative soil sample. Its processing and storage. Study of soil forming rocks and minerals. Determination of soil density, moisture content and porosity . Determination of soil texture by feel and Bouyoucos methods . Determination of soil pH and electrical conductivity. Estimation of organic matter content of soil.

Suggested Readings:-

1. Indian Society of Soil Science, 2002. Fundamentals of Soil Science, ISSS, New Delhi.
2. Das, D.K.(2010) Introductory Soil Science, Kalyani Publications New Delhi.
3. Brady, N.C. & Weil, R.R. (2002) The Nature and Properties of Soils, 13th Ed., Pearson Edu.

4. Bear, R.E. (1964) Chemistry of soil. Oxford & IBH.
5. Buol, EW, Hole, ED, Mac Cracken RJ & Southard RJ (1997) Soil Genesis & Classification, 4th Ed. Panima Publications.
6. Singh, Vinay(2018) Soil Science, Bharti Bhandar, Meerut.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
3	Agricultural Microbiology	2 (1+1)	50	20	30	III

Theory

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological Nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: biofertilizers, biopesticides, biofuel production and biodegradation. Microbial degradation of organic matter in soil. Preparation of Vermicompost. Soil organisms: macro and micro organisms, their beneficial and harmful effects.

Introduction Microbial world: Prokaryotic and eukaryotic microbes, Bacteria; chemiautotrophy & photo autotrophy,

Practical

Introduction to microbiology laboratory and its equipments; principles of microscopy. Methods of sterilization. Nutritional media and their preparations, Enumeration of microbial population in soil – bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures.

Isolation of rizobium from legume root nodule. Gram staining of bacteria. Preparation of nutrient broth, BGA and Vermicompost.

Suggested Readings:-

1. Subbarao, N.S. () Soil Microbiology, Oxford & IBH Publications.
2. Alexander, M. (1977) Introductory Soil Microbiology, John Wiley & Sons.
3. Sylvia, D.N. (2005), Principles and Applications of Soil Microbiology, Pearson Edu.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
4	Problematic Soils and their Management	2 (1+1)	50	20	30	IV

Theory

Soil quality and health, Distribution of waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soil, Acid soils, Acid Sulphate soil, Eroded and Compacted soils, Flooded soils, & Polluted soils.

Irrigation water: Quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problem soils.

Practical

Determination of pH & EC in soil and water. Lime and Gypsum requirement in soil, ESP and SAR in Soils. Determination of Carbonate, B.carbonate, Calcium, Magnesium, Chloride & RSC in irrigation water samples.

Suggested Readings:-

1. Das, D.K.(2010) Introductory Soil Science, Kalyani Publications New Delhi
2. Yadav, J.S.P., Agrawal R.R. and Gupta R.N.(), Saline and Alkali Soils of India. I.A.R.I. New Delhi.
3. Biswas, T.D. and Narayanasamy, G. (Eds.)(1996). Soil Management in relation to land Degradation and Environment. Bull. Indian Society of Soil Science, 17, New Delhi.
4. Richards, L.A. () Diagnosis and Improvement of saline and Alkali Soils. USDA, Hand

Book No. 60.

5. Brady, N.C. & Weil, R.R. (2002) The Nature and Properties of Soils, 13th Ed., Pearson Edu

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
5	Manures, Fertilizers and Soil Fertility Management	3 (2+1)	50	20	30	VI

Theory

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management.

Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, complex fertilizers, nano fertilizers

Soil amendments, Fertilizers Storage, Fertilizer Control Order.

History of soil fertility and plant nutrition, criteria of essentiality, forms of nutrients in soil. Role, deficiency and toxicity Symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

Practical

Introduction of analytical instruments and their applications, colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of available N, available P, available K, available S, available Ca and Mg and available Zn in soils. Estimation of N,P & K in plants. Manures and fertilizers.

Suggested Readings:-

1. Tisdale, S.L., Nelson, S.L., Beaton, J.D. & Harlin, J.L.(1999). Soil Fertility & Fertilizers, 5th Edition, Prentice Hall of India
2. Kanwar, J.S.(Ed.)(1976). Soil Fertility : theory & Practice, ICAR, New Delhi.
3. Das, D.K.(2010) Introductory Soil Science, Kalyani Publications New Delhi.
4. Tandon, HLS (2005). Fertilizers, Organic Manures & Biofertilizers a Product quality guide. for major & micronutrients, FDCO, New Delhi
5. Tandon, HLS (1993). Methods of Analysis of Soils, Fertilizers & Waters, FDCO, New Delhi.

ENTOMOLOGY

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
1	Fundamentals of Entomology	4 (3+1)	50	20	30	II

Part - I-

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

Part-II

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

Part III

Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control—importance, hazards and limitations. repellents, antifeedants, hormones, attractants, gamma radiation. Insecticides Act 1968-Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.

Part - IV

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

Practical

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

Related Books:

1. Fundamentals of Agriculture Entomology- P.K. Sehgal, Kalyani Publications.
 2. Elements of Agriculture Entomology- G.S. Dhaliwal, Kalyani Publications.
 3. Insect Structure and Function- R.F. Chapman, Publication: Cambridge University Press.
 4. A Textbook of Entomology- Y.K. Mathur and K.D. Upadhayay, Aman Publishers.
- Modern Entomology- D.B. Tembhare, Himalaya Publishing House

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
2	Management of Beneficial Insects	2 (1+1)	50	20	30	III

Theory

Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkworm and methods of disinfection.

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products.

Practical

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

1. Textbook of bookkeeping perspective for skill development- Rahman Aatur, Kalyani Publications.
2. Bee and Beekeeping in India- D.P. Aral.
3. Honey Bee Disease and their Management- D.P. Aral, Kalyani Publishers.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
3	Pests of Crops and Stored Grains and their Management	3 (2+1)	50	20	30	IV

Theory

General account on nature and type of damage by different arthropods (mites) pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and Scientific name, order, family, host range, distribution, nature of damage and control practice of important insect pests of important field crop, vegetable crop, fruit crop, plantation crops, ornamental crops, spices and condiments. Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to nearest FCI godowns.

Related Books

1. Stored Grain Pest and their Management, D.P. Khare, Kalyani Publishers.
2. Agriculture Insect Pest of Crop and their Control- V.P.S. Panwar, Kalyani Publishers.
3. Agricultural Pest of South Asia and their Management- A.S. Atwal & G.S. Dhaliwal, Kalyani Publishers.

4. Insect Pest of Vegetable Crops- R.S. Chandel, P.K. Mehta, P.C. Sharma, Kalyani Publications.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
4	Principal of Integrated Pest Management	2 (1+1)	50	20	30	V

Theory

Categories of insect pests IPM; Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, pest risk analysis. Methods of detection and diagnosis of insect pest calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Survey surveillance and forecasting of Insect pest. Safety issues in pesticide uses.

Practical

Methodes of diagnosis and detection of various insect pests, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of Trichogramma, NPV etc.

1. Textbook of IPM- Dhaliwal & G.S. Rana.
2. Integrated Pest Management. Concept and Approaches- G.S. Dhaliwal and G.S. Arora, Kalyani Publications.
3. A Textbook of Applied Entomology: Volume I- Concepts in Pest Management- K.P. Srivastava and G.S. Dhoniwal, Kalyani Publishers.
4. A Textbook of Applied Entomology: Volume II- Insects of Economic Importance- K.P. Srivastava and G.S. Dhoniwal, Kalyani Publishers.

AGRICULTURAL ECONOMICS

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
1	Fundamentals of Agricultural Economics	2 (2+0)	80	20	00	II

Theory

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. **Demand:** meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Concepts of rent, wage, interest and profit. **National income:** Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. public revenue and public expenditure. **Tax:** meaning, direct and indirect taxes, agricultural taxation, VAT. **Economic systems:** Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

Related Books

1. R.K. Lekhi & Joginder Singh (2017), "Agriculture Economics" Kalyani Publishers.
2. Subba Reddy, P. Raghu Ram, T.V. Neelakanta Sastry & I Bhavami Devi, "Agricultural Economics" Oxford & IBH Publishing Co. Pvt. Ltd.
3. S.S. Chima & N. Singh, "Farm Management in India", Kalyani Publishers.
4. S.S. Johal & T.R. Kapoor, "Fundamentals of Farm Business Management", Kalyani Publishers.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
2	Agricultural Finance and Co-Operation	3 (2+1)	50	20	30	III

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, world bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis.

Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.

Practical's

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprise. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal – A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Seminar on selected topics.

Related Books

1. J.V. Vaishampayan, Micro-Economic Theory, Royal Publisher Company.
2. S. Subba Reddy & P. Raghu Ram, "Agricultural Finance and Management", Oxford & IBH Publishing Company Pvt. Ltd.

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
3	Agricultural Marketing, Trade and Prices	3 (2+1)	50	20	30	V

Theory

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities; nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR GST.

Practical

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

Related Books:

1. S.S. Acharya & N.L. Agrawal, "Agricultural Marketing in India", Oxford & IBH Publishing Co. Pvt. Ltd.

2. Philip Kotler, "Marketing Management", Prentice Hall PTR, 2011

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
4	Farm Management, Production and Resource Economics	2 (1+1)	50	20	30	VI

Theory

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

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

Related Books:

1. Economics of Farm Production & Management", V.T. Roy & DVS Rao, Oxford & IBH Publishing Co. Pvt. Ltd.
2. S.P. Dhondyal, Farm Maragement "An Economic Analysis", Aman Publishing House.
3. A.N. Agarwal & Singh, K (1992), "Economics of Farm Management in India", Allied Publication.
4. Panda, S.C. (2007), "Farm Management & Agricultural Marketing", Kalyani Publication.

AGRICULTURAL ENGINEERING

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
1	Introductory Soil and Water Conservation Engineering	2 (1+1)	50	20	30	II

Theory

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

Practical

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

Related Books:

1. Principal Of Agricultural Engineering, Vol -II , by A M Miechel, TP Ojha-Jain Brothers
2. Elements of Agricultural Engineering, by Jagdishwar Sahay-Standard Publisher
3. Agricultural Technologies on Agricultural Engineering Vol.I,- ICAR Publication
4. Agricultural Technologies on Agricultural Engineering Vol.II, - ICAR Publication
5. Agricultural Technologies on Natural Resources Management -ICAR Publication
6. Irrigation and Water Resource Engineering, Asawa G L, New Age International (P) Ltd
7. Soil Erosion and Conservation, R P Tiwari, New Age International (P) Ltd
8. Soil & Water Conservation Engineering, Bimal Chand Mall, Ashish Pandey -Kalyani Publications

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
2	Farm Machinery and Power	2 (1+1)	50	20	30	III

Theory

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

Practicals

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow . Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and

transplanter Familiarization with different types of sprayers and dusters Familiarization with different inter-cultivation equipment, Familiarization with harvesting and threshing machinery.

Related Books:

1. **Principal Of Agricultural Engineering Vol -I** , by A M Mischel, TP Ojha- Jain Brothers
2. **Elements of Agricultural Engineering**, by Jagdishwar Sahay-Standard Publisher
3. **Agricultural Technologies on Agricultural Engineering Vol.I-** ICAR Publication
4. **Agricultural Technologies on Agricultural Engineering Vol.II,** - ICAR Publication
5. **Farm Power and Machinery**, Sanjay Kumar, Kalyani Publications

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
3	Renewable Energy and Green Technology	2 (1+1)	50	20	30	IV

Theory

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bioalcohol, biodiesel and biooil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, introduction of wind energy and their application.

Practical

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

Related Books:

1. **Elements of Agricultural Engineering**, by Jagdishwar Sahay-Standard Publisher
2. **Agricultural Technologies on Agricultural Engineering Vol.I-** ICAR Publication
3. **Agricultural Technologies on Agricultural Engineering Vol.II,** - ICAR Publication
4. **Renewable Energy**, Sanjay Kumar, Kalyani Publications

S.No	Title	Credit	Marks Distribution			Semester
			T	I	P	
4	Protected Cultivation and Secondary Agriculture	2 (1+1)	50	20	30	V

Theory

Green house technology: Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying.

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

Practical

Study of different type of green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green