

DAV UNIVERSITY, JALANDHAR

DAV UNIVERSITY JALANDHAR



FACULTY OF AGRICULTURAL SCIENCES

COURSE CURRICULUM

FOR

B.Sc. (Hons.) AGRICULTURE

(Program ID - 1)

(4 Years Course)

1st to 8th SEMESTER

Examinations 2021–2022 session onwards

Applicable for admissions in 2021

DAV UNIVERSITY, JALANDHAR

Scheme of Courses B.Sc. (Hons.) Agriculture Semester 1

S. No	Paper Code	Course Title	L	T	P	Cr
1.	AGS 111	Fundamentals of Agronomy	3	0	2	4
2.	AGS 112	Fundamentals of Agricultural Economics	2	0	0	2
3.	AGS 113	Fundamentals of Genetics	2	0	2	3
4.	AGS 114	Communication Skills and Personality Development	2	0	0	2
5.	AGS 115	Fundamentals of Soil Science	2	0	2	3
6.	AGS 116A	Introductory Agro-meteorology & Climate Change	1	0	2	2
7.	AGS 117	Agricultural Heritage	1	0	0	1
8.	AGS 118	Introductory Biology**	1	0	2	2
9.	AGS 118A	Elementary Mathematics**	2	0	0	2
10.	AGS 119	Introduction to Forestry	1	0	2	2
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** - Student will have to opt either of these courses on the basis courses studied in 10+2
L: Lecture; T: Tutorial; P: Practical; Cr: Credit

Semester 2

S. No	Paper Code	Course Title	L	T	P	Cr
1	AGS 121	Agricultural Microbiology	1	0	2	2
2	AGS 122	Fundamentals of Agricultural Extension Education	2	0	2	3
3	AGS 123	Fundamentals of Crop Physiology	1	0	2	2
4	AGS 124	Fundamentals of Entomology	3	0	2	4
5	AGS 125	Fundamentals of Horticulture	1	0	2	2
6	AGS 126	Fundamentals of Plant Biochemistry and Biotechnology	2	0	2	3
7	AGS 127	Fundamentals of Plant Breeding	2	0	2	3
8	CSA 257	Agri- Informatics	1	0	2	2
9	ENG 153B	Comprehension & Communication Skills in English	1	0	2	2
10	AGS107B	Human Values & Ethics	1	0	0	1
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L: Lecture; T: Tutorial; P: Practical; Cr: Credit

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Scheme of Courses B. Sc. (Hons.) Agriculture Semester 3

S. No	Paper Code	Course Title	L	T	P	Cr
1	AGS 211	Crop Production Technology – I (<i>Kharif Crops</i>)	1	0	2	2
2	AGS 212	Fundamentals of Plant Pathology	3	0	2	4
3	AGS 213	Agricultural Finance and Cooperation	2	0	2	3
4	AGS 214	Farm Machinery and Power	1	0	2	2
5	AGS 215	Principles of Seed Technology	1	0	4	3
6	AGS 216	Production Technology for Vegetables and Spices	1	0	2	2
7	AGS 217	Statistical Methods	1	0	2	2
8	AGS 218	Livestock and Poultry Management	3	0	2	4
9	AGS 219	Rural Sociology & Educational Psychology	2	0	0	2
10	AGS101 /PHE 110	NSS/NCC/Physical Education & Yoga Practices	0	1	4	2
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L: Lecture; T: Tutorial; P: Practical; Cr: Credit

Semester 4

S. No	Paper Code	Course Title	L	T	P	Cr
1	AGS 221	Crop Production Technology –II (<i>Rabi Crops</i>)	1	0	2	2
2	AGS 222	Production Technology for Ornamental Crops, MAP and Landscaping	1	0	2	2
3	AGS 223	Renewable Energy and Green Technology	1	0	2	2
4	AGS 224	Manures, Fertilizers and Soil Fertility Management	2	0	2	3
5	AGS 225	Production Technology for Fruit and Plantation Crops	1	0	2	2
6	AGS 226	Farming System & Sustainable Agriculture	1	0	0	1
7	AGS 227	Agricultural Marketing Trade & Prices	2	0	2	3
8	AGS228A	Soil and Water Conservation Engineering	1	0	2	2
9	EVS 212	Environmental Studies and Disaster Management	2	0	2	3
10	AGS102/ PHE130	NSS/NCC/Physical Education & Yoga Practices	0	1	4	2
11		Elective Course#	2	0	2	3
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L: Lecture; T: Tutorial; P: Practical; Cr: Credit

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Scheme of Courses B. Sc. (Hons.) Agriculture Semester 5

S. No	Paper Code	Course Title	L	T	P	Cr
1	AGS 311	Principles of Integrated Pest and Disease Management	2	0	2	3
2	AGS 312	Problematic Soils and their Management	2	0	0	2
3	AGS 313	Pests of Crops and Stored Grain and their Management	2	0	2	3
4	AGS 314	Diseases of Field and Horticultural Crops and their Management -I	2	0	2	3
5	AGS 315	Crop Improvement-I (<i>Kharif Crops</i>)	1	0	2	2
6	AGS 316	Entrepreneurship Development and Business Communication	1	0	2	2
7	AGS 317	Geoinformatics and Nano-technology and Precision Farming	1	0	2	2
8	AGS 318	Practical Crop Production – I (<i>Kharif crops</i>)	0	1	4	2
9	AGS 319	Intellectual Property Rights	1	0	0	1
10		Elective Course#	2	0	2	3
						24

L: Lecture; T: Tutorial; P: Practical; Cr: Credit

Semester 6

S. No	Paper Code	Course Title	L	T	P	Cr
1	AGS 320	Rainfed Agriculture & Watershed Management	1	0	2	2
2	AGS 321	Protected Cultivation and Secondary Agriculture	1	0	2	2
3	AGS 322	Diseases of Field and Horticultural Crops and their Management-II	2	0	2	3
4	AGS 323	Post-harvest Management and Value Addition of Fruits and Vegetables	1	0	2	2
5	AGS 324	Management of Beneficial Insects	1	0	2	2
6	AGS 325	Crop Improvement-II (<i>Rabi crops</i>)	1	0	2	2
7	AGS 326	Practical Crop Production –II (<i>Rabi crops</i>)	0	1	4	2
8	AGS 327	Principles of Organic Farming	1	0	2	2
9	AGS 328	Farm Management, Production & Resource Economics	1	0	2	2
10	AGS 329	Principles of Food Science and Nutrition	2	0	0	2
11	AGR 330	Elective Course#	2	0	2	3
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L: Lecture; T: Tutorial; P: Practical; Cr: Credit

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Scheme of Courses B. Sc. (Hons.) Agriculture Semester 7

STUDENT READY PROGRAMME -I

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 **VII semester**.

S. No	Paper Code	Course Title	L	T	P	Cr
1	AGS 411A	Production Technology for Bioagents and Biofertilizer	0	1	20	10
2	AGS 411B	Seed Production and Technology	0	1	20	10
3	AGS 411C	Mushroom Cultivation Technology	0	1	20	10
4	AGS 411D	Commercial Beekeeping	0	1	20	10
5	AGS 411E	Agriculture Waste Management	0	1	20	10
6	AGS 411F	Floriculture and Landscaping	0	1	20	10
7	AGS 411G	Commercial Horticulture	0	1	20	10
30	AGS 411H	Poultry Production Technology	0	1	20	10
30	AGS 411I	Food Processing	0	1	20	10
30	AGS 411J	Organic Production Technology	0	1	20	10
11	AGS 411K	Commercial Sericulture	0	1	20	10
12	AGS 411L	Soil, Plant, Water and Seed Testing	0	1	20	10
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Syllabus of the modules will be decided in the next BOS meeting
L: Lecture; T: Tutorial; P: Practical; Cr: Credit

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**Scheme of Courses B.Sc (Hons.) Agriculture
Semester 8**

STUDENT READY PROGRAMME –II (RAWE)

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 Univ./ 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

SN.	Paper Code	Course Title	L	T	P	Cr
1	AGS 421	General orientation & On campus training by different faculties Village attachment Unit attachment in Univ./ College. KVK/ Research Station Attachment	0	1	28	14
2	AGS 422	Plant clinic	0	1	4	2
3	AGS 423	Agro-Industrial Attachment	0	1	8	4
						20

L: Lecture; T: Tutorial; P: Practical; Cr: Credit

**RAWE
Village Attachment Training Programme**

Component-I

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

**RAWE Component –II
Agro Industrial Attachment**

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

- Students shall be placed in Agro-and Cottage industries and Commodities Boards for 03 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

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Elective Courses: A student can select three elective courses out of the following and offer during 4th, 5th and 6th semesters.

S. No	Paper Code	Course Title	L	T	P	Cr
1	AGS 229A	Agribusiness Management	2	0	2	3
2	AGS 229B	Agrochemicals	2	0	2	3
3	AGS 229C	Commercial Plant Breeding	1	0	4	3
4	AGS 229D	Landscaping	2	0	2	3
5	AGS 310A	Food Safety and Standards	2	0	2	3
6	AGS 310B	Biopesticides & Biofertilizers	2	0	2	3
7	AGS 310C	Protected Cultivation	2	0	2	3
8	AGS 310D	Micro propagation Technologies	1	0	4	3
9	AGS 330A	Hi-tech. Horticulture	2	0	2	3
10	AGS 330B	Weed Management	2	0	2	3
11	AGS 330C	System Simulation and Agro-advisory	2	0	2	3
12	AGS 330D	Agricultural Journalism	2	0	2	3

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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 **VII semester**.

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

NOTE: In addition to above ELP modules other important modules may be given to the students by the university

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

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SYLLABUS

I AGRONOMY

Paper Code	Course Title	L	T	P	Cr
AGS 111	Fundamentals of Agronomy	3	0	2	4

Course Objectives: To teach concepts of crop cultivation, crop nutrition and water management, weeds and their management, identification of important crops, and crop seeds and crop management strategies.

Theory

UNIT I

Introduction of Agronomy and its scope, role of Agronomist, seeds and sowing, tillage and tith, crop density and geometry, crop nutrition.

UNIT II

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.

UNIT III

Weeds- importance, classification, crop weed competition, concept of weed management- principles and methods, herbicides- classification, mode of action of herbicides, herbicide selectivity and resistance, allelopathy.

UNIT IV

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

Practical

Identification of crops, seeds, fertilizers, pesticides and tillage implements, study of agro-climatic zones of India, Identification of weeds in crops, Methods of herbicide and fertilizer application, Study of yield contributing characters and yield estimation, Seed germination and viability test, Numerical exercises on fertilizer requirement, plant population, herbicides and water requirement, Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill, Measurement of soil moisture, field capacity, bulk density and infiltration rate, Measurement of irrigation water.

Suggested Readings:

1. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
2. Reddy, T. Yellamanda & Reddy, G.H Sankara, 2015. Principles of Agronomy Kalyani Publishers,
3. Balasubramaniyan, P. and Palaniappan, S.P., 2016. Principles and Practices of Agronomy (2nd edition), Agrobios (India), Jodhpur
4. Reddy, T. Yellamanda and Reddy, G.H. Sankara, 2016. Principles of Agronomy (2nd edition), Kalyani Publishers, Ludhiana
5. Reddy, S.R., 2012. Principles of Crop Production (4th edition), Kalyani Publishers, Ludhiana.

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Paper Code	Course Title	L	T	P	Cr
AGS 116A	Introductory Agro meteorology & Climate Change	1	0	2	2

Course Objectives: To provide an understanding earth atmosphere, monsoon, weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions, agriculture and weather relations, weather forecasting

Theory

UNIT I

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height. Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze.

UNIT II

Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth.

UNIT III

Atmospheric humidity, concept of saturation, vapour pressure, process of condensation, formation of dew, fog, mist, frost, cloud. Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave.

UNIT IV

Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

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

Suggested Readings:

1. Lal, D.S. 2005 Climatology, Sharda Pustak Bhawan, Allahabad.
2. Varshneya, M.C. and Balakrishna, Pillai, 2003. Text book of Agricultural Meteorology. ICAR, New-Delhi.
3. Sahu, D.D., 2007. Agrometeorology and Remote Sensing: Principles and Practices, Agrobios (India), Jodhpur.
4. Panda, S.C.2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
5. Balasubramaniyan, P. and Palaniappan, S.P.2016. Principles and Practices of Agronomy, Agrobios (India), Jodhpur
6. Reddy, S.R., 2016. Introduction to Agriculture and Agrometeorology. Kalyani Publishers, Ludhiana.

Paper Code	Course Title	L	T	P	Cr
AGS 211	Crop Production Technology-I (<i>Kharif</i> Crops)	1	0	2	2

Course Objectives: The Objective of the course is to acquaint students the origin, geographical distribution, economic importance, soil and climatic requirements, varieties, yield and package of practices of *Kharif* Crops including cereals, pulses, oilseeds, fibre and forage crops.

Theory

UNIT I

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops: Package and practices of cereal crops – rice, maize, sorghum, pearl millet and finger millet

UNIT II

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops: Package and practices of pulse crops- pigeonpea, mungbean and urdbean;

UNIT III

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops: Cultivation practices of oilseed crops- sesame, groundnut, and soybean.

UNIT IV

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops: Production technology of fibre and forage crops: fibre crops- cotton & Jute and forage crops- sorghum, cowpea, cluster bean, napier hybrid and guinea grass

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,

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study of yield contributing characters and yield calculation of *kharif* season crops, study of crop varieties and important agronomic experiments at experimental farm. study of forage experiments, morphological description of *kharif* season crops, visit to research centres of related crops.

Suggested Readings:

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
3. Singh, S.S. and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production, Agrobios (India), Jodhpur.

Paper Code	Course Title	L	T	P	Cr
AGS 221	Crop Production Technology-II (<i>Rabi</i> Crops)	1	0	2	2

Course Objectives: The objective of the course is to acquaint students the origin, geographical distribution, economic importance, soil and climatic requirements, varieties, yield and package of practices of *Rabi* crops including cereals, oilseeds, forage, medicinal and aromatic crops.

Theory

UNIT I

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.

UNIT II

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops: Oilseeds-rape seed, mustard, sunflower and sugar crops-sugarcane and sugar beet.

UNIT III

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops: Medicinal and aromatic crops-mentha, lemon grass and citronella, Cash crops- potato and tobacco

UNIT IV

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops: Forage crops-berseem, lucerne and oat.

Practical

Sowing methods of wheat and sugarcane, identification of weeds in *rabi* season crops, study of morphological characteristics of *rabi* crops, study of yield contributing characters of *rabi* season crops, yield and juice quality analysis of sugarcane, study of important agronomic

experiments of *rabi* crops at experimental farms. Study of *rabi* forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

Suggested Readings:

1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi.
2. Singh, S.S. 1998. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
3. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India), Jodhpur
4. Singh, S.S. and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi.
5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production. Agrobios (India), Jodhpur.
6. Prasad, Rajendra. 2002. Text Book of Field Crops Production. ICAR, New Delhi.

Paper Code	Course Title	L	T	P	Cr
AGS 226	Farming System and Sustainable Agriculture	1	0	0	1

Course Objectives: To provide knowledge on farming system, efficient cropping system, allied enterprises, sustainable agriculture and integrated farming system.

Theory

UNIT I

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components, interactions and their maintenance.

UNIT II

Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system;

UNIT III

Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability,

UNIT IV

Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers’ field.

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Suggested Readings:

1. Walia, U.S., Walia, S.S., Kler, D.S. and Singh Dalip, 2011. Science of Agronomy, Scientific Publishers
2. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Books, New Delhi
3. ICAR. 2010. Handbook of Agriculture (6th edition), Indian Council of Agricultural Research, New Delhi.
4. Reddy, S.R. 2012. Agronomy of Field Crops. Kalyani Books, New Delhi

Paper Code	Course Title	L	T	P	Cr
AGS 318	Practical Crop Production-I (<i>Kharif Crop</i>)	0	1	4	2

Course Objectives: to grow *Kharif* Crops in field by individual student

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.

Suggested Readings:

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

Paper Code	Course Title	L	T	P	Cr
AGS 326	Practical crop Production-II (<i>Rabi Crops</i>)	0	1	4	2

Course Objectives: Growing *Rabi* crops in field by individual student

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.

Suggested Readings:

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

Paper Code	Course Title	L	T	P	Cr
AGS 327	Principles of Organic Farming	1	0	2	2

Course Objectives: To provide students an understanding of organic farming, initiatives for promotion of organic agriculture, concepts of organic ecosystem, nutrient resources, pest, disease and weed management, certification standards and market potential of organic products

Theory

UNIT I

Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture.

UNIT II

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.

UNIT III

Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP.

UNIT IV

Certification process and standards of organic farming; Processing, levelling, economic considerations and viability, marketing and export potential of organic products.

Practical

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

Suggested Readings:

1. Sharma, A.K., 2002. Biofertilizers for Sustainable Agriculture. Agrobios (India), Jodhpur.
2. Kannaiyan, S. Kumar, K & Govindarajan K. 2004. Biofertilizers Technology. Scientific Publ.
3. Gaur, A.C. 2006. Biofertilizers in Sustainable Agriculture. ICAR, New Delhi.

4. Palaniappan, S.P. and Annadurai, K. 2012. Organic farming theory and practice. Scientific Publishers

Paper Code	Course Title	L	T	P	Cr
AGS 317	Geoinformatics, Nano-technology and Precision Farming	1	0	2	2

Course Objectives: To provide an understanding on concepts and use of precision agriculture and geo-informatics, concepts and applications of remote sensing, global positioning system (GPS), use of system simulation and nanotechnology for enhancing farm productivity.

Theory

UNIT I

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture.

UNIT II

Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation.

UNIT III

Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach including site specific nutrient management. Precision agriculture, micro-irrigation and fertigation.

UNIT IV

Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

Practical

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

Suggested readings:

1. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press

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2. Srivastava, G.S. 2014. An Introduction to Geoinformatics. McGraw Hill Education (India) Pvt. Ltd., New Delhi
3. Gupta, R.K. and Subhash Chander. 2008. Principles of Geoinformatics. Jain Brothers, New Delhi.
4. Choudhary, S. 2011. Applied Nanotechnology in Agriculture. Arise Publishers & Distributors

Paper Code	Course Title	L	T	P	Cr
AGS 320	Rainfed Agriculture and Watershed Management	1	0	2	2

Course Objectives: To provide detailed knowledge on rainfed agriculture, soil and water conservation techniques, water harvesting and crop planning for aberrant weather conditions.

Theory

UNIT I

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India; Soil and climatic conditions prevalent in rainfed areas.

UNIT II

Soil and water conservation techniques, Drought: types, effect of water deficit on physiological characteristics of the plants, Crop adaptation and mitigation to drought.

UNIT III

Water harvesting: importance, its techniques, efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas.

UNIT IV

Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

Practical

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

Suggested readings:

1. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana.
2. Reddy, S.R. and Reddy, G. Prabhakara. 2015. Dryland Agriculture, Kalyani Publishers, Ludhiana.

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3. Murthy, J. V. S. 1994. Watershed Management, Wiley Eastern Limited. New Age International Limited, New Delhi.
4. Dhruva Narayan, V.V. Singh, P.P., Bhardwaj, S.P., U. Sharma, Sikha, A.K., Vital, K.P.R. and Das, S.K. 1987. Watershed Management for Drought Mitigation, ICAR, New Delhi.
5. Singh, R.P., Sharma, S., Padmnabhan, N.V., Das, S.K. and Mishra, P.K. 1990. A Field Manual on Watershed Management, ICAR (CRIDA), Hyderabad.

II GENETICS AND PLANT BREEDING

Paper Code	Course Title	L	T	P	Cr
AGS 113	Fundamentals of Genetics	2	0	2	3

Course Objectives: To teach students about the basic concepts of genetics like the laws of Mendelian inheritance and extensions to Mendelian genetics, structure and functions of genetic material i.e. chromosomes and DNA and gene expression and its regulation through transcription and translation.

Theory

UNIT I

Mendelian genetics: extension and exceptions to the Mendelian laws. Multiple alleles and Multiple factor hypothesis. Pleiotropism, Penetrance and expressivity. Quantitative and Qualitative traits and differences between them. Sex linked inheritance. Population genetics

UNIT II

Ultra structure of cell and cell organelles and their functions. Mitosis and meiosis, their significance and differences between them. Cytoplasmic inheritance: its characteristic features and difference between chromosomal and cytoplasmic inheritance.

UNIT III

Study of chromosome structure, morphology, number and types, Karyotype and Idiogram. Numerical chromosomal aberrations (Polyploidy) and Structural chromosomal aberrations and their role in evolution of different crop species like Cotton, Wheat, Tobacco, Triticale and Brassicas. Crossing over and factors affecting it, Mechanism of crossing over and Cytological proof of crossing over. Linkage, Types of linkage and estimation of linkage. Linkage map.

UNIT IV

DNA and its structure, function, types, modes of DNA replication and DNA repair. RNA and its structure, function and types. Gene expression and its regulation; Lac operon and Fine structure of Gene. Genetic code, Transcription and Translation. Mutation and its characteristic features, Methods of inducing mutations and CIB technique. Transposable and repetitive DNA.

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.

Suggested Readings:

1. Singh, B.D. 2014. Fundamentals of Genetics. Kalyani Publishers.
2. Gardner, E.J. 2006. Principles of Genetics. John Wiley and Sons.
3. Winter, P.C., Hickey, G.I. and H.L. 1999. Fletcher Instant Notes; Genetics. BIOS Publications.

4. Benjamin A. Pierce. 2014. Genetics: A conceptual Approach. Freeman Publications.

Paper Code	Course Title	L	T	P	Cr
AGS 127	Fundamentals of Plant Breeding	2	0	2	3

Course Objectives: To acquaint students with historical developments and future prospects of plant breeding, study of floral structures, modes of pollination and reproduction and their genetic consequences, breeding methods in self-pollinated, cross-pollinated and vegetatively propagated crops and various innovative breeding techniques.

Theory

UNIT I

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.

UNIT II

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.

UNIT III

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

UNIT IV

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, Speed breeding.

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.

Suggested Readings:

1. Allard, R.W., 2000. Principles of Plant Breeding. John Willey & Sons, New York.

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2. Chahal, G.S. and S.S. Ghosal, 2002. Principles and Procedures of Plant Breeding, Biotechnological and Conventional Approaches. Narosa Publishing House, New Delhi.
3. Singh, P., 2001. Essentials of Plant Breeding- Principles and Methods. Kalyani Publishing House, New Delhi.
4. Jain, H.K. and M.C. Kharkwal, 2004. Plant Breeding- Mendelian to Molecular Approach. Narosa Publishing House, New Delhi.
5. Sharma, A.K., 2005. Breeding Technology of Crop Plants. Yash Publishing House, Bikaner.
6. Singh, B.D., 2015. Plant Breeding: Principles and Methods. Kalyani Publishers, New Delhi.
7. Shekhawat, S. S. (ed) 2016. Advances and Current Issues in Agriculture, Vol. III. Shiksha Prakashan, S. M. S. Highway, Jaipur.

Paper Code	Course Title	L	T	P	Cr
AGS 215	Principles of Seed Technology	1	0	4	3

Course Objectives: To teach students about seed and seed technology, seed certification, maintenance of seed quality standards during seed production, processing and marketing, legislation, foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables crops.

Theory

UNIT I

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables.

UNIT II

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.

UNIT III

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.

UNIT IV

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

Suggested readings:

1. Agarwal, R.L. 1991. Seed Technology. Oxford & IBH Publishing Co. Delhi
2. Agarwal, P.K. 1999. Seed Technology. ICAR, New Delhi.
3. Sen, Subir and Ghosh, Nabinanda. 2015. Seed Science and Technology. Kalyani Publishers. New Delhi.
4. Khare, Dhirendera and Bhale, Mohan S. 2000. Seed Technology. Scientific Publishers (India), Jodhpur.
5. Maloo, S.R., Intodia, S.K. and Pratap Singh. 2008. Beej Pradyogiki. Agrotech Publishing Academy.
6. Joshi, A.K. and Singh, B.D. 2013. Seed Technology. Kalyani Publishers, New Delhi.
7. Basavraju, G. V., Ravishankar, P. and Gowdiperu, Sarika. 2014. A Text book of Seed Science and Technology. Kalyani Publishers.

Paper Code	Course Title	L	T	P	Cr
AGS 315	Crop Improvement – I (<i>Kharif</i>)	1	0	2	2

Course Objectives: To teach students about origin and distribution of species of different *Kharif* crops, conventional and modern innovative approaches for development of hybrids and varieties for stress tolerance and quality traits in *Kharif* crops. Hybrid seed production technology, ideotype and climate resilient crop breeding in different *Kharif* crops

Theory

UNIT 1

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, their utilization and conservation.

UNIT II

Study of genetics of qualitative and quantitative characters; important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops.

UNIT III

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).

UNIT IV

Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeon pea, etc. Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeon pea, Urd bean, Mung bean, Soybean, Groundnut, Sesame, Castor, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. 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.

Suggested Readings:

1. Ram Hari Har. 2011. Crop Breeding and Biotechnology. Kalyani Publishers, New Delhi
2. Chopra, V.L. 2000. Breeding of Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Mandal, A. K., 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 Twenty-First Century (ed). International Book Distributing Co. Lucknow.
5. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Connecticut, 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 (ed.). Yash Publishing House, Bikaner.
8. Poehlman, J. M. and Sleper, D. A. 2006. Breeding Field Crops. Blackwell Publishing

Paper Code	Course Title	L	T	P	Cr
AGS 325	Crop Improvement – I (<i>Rabi</i>)	1	0	2	2

Course Objectives: To acquaint students with origin and distribution of species of different *Rabi* crops, conventional and modern innovative approaches for development of hybrids and varieties for stress tolerance and quality traits in *Rabi* crops. Hybrid seed production technology, ideotype and climate resilient crop breeding in different *Rabi* crops

Theory

UNIT 1

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops.

UNIT II

Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters.

UNIT III

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).

UNIT IV

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, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion; 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.

Suggested Readings:

1. Ram Hari Har, 2011. Crop Breeding and Biotechnology. Kalyani Publishers, New Delhi
2. Poehlman, J.M. 1987. Breeding of Field Crops. AVI Publishing Co. INC, East Port, Connecticut, USA.
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. Ram, H.H. and H.G. Singh, 1994. Crop Breeding and Genetics. Kalyani Publishers, New Delhi.
5. Chopra, V.L. 2000. Breeding of Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Kang, Manjit S. 2004. Crop Improvement: Challenges in the Twenty-First Century (ed). International Book Distributing Co. Lucknow.
7. Poehlman, J. M. and Sleper, D. A. 2006. Breeding Field Crops. Blackwell Publishing

III SOIL SCIENCE & AGRICULTURAL CHEMISTRY

Paper Code	Course Title	L	T	P	Cr
AGS 115	Fundamentals of Soil Science	2	0	2	3

Course Objectives: To provide an understanding about soil, soil genesis, soil taxonomy and classification, soil profile, physical properties of soil, soil reaction, soil organic matter and soil pollution.

Theory

UNIT I

Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth. Soil water retention, movement and availability.

UNIT II

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; Elementary knowledge of soil taxonomy classification and soils of India.

UNIT III

Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation.

UNIT IV

Soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and microorganisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

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. Studies of capillary rise phenomenon of water in soil column and water movement in soil. Determination of soil pH and electrical conductivity. Determination of cation exchange capacity of soil. Study of soil map. Determination of soil colour. Demonstration of heat transfer in soil. Estimation of organic matter content of soil.

Suggested Readings:

1. Sehgal, J. 2000. Pedology: Concepts and Applications. Kalyani publisher, Ludhiana
2. Mehra R.K. 2004. Text book of Soil Science. ICAR, New Delhi.
3. Boul S.W., Hole R.D., McCracken and Southard R.J., 1998. Soil genesis and classification. Fourth Ed. Panima Publishing Corporation, New Delhi.
4. Baver, L.D. Gardener, W.H. and Gardener W.R. 1976. Soil Physics. Wiley Eastern Ltd, New Delhi.

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5. Biswas, T.D. and Mukherjee, S.K. 2006 Text book of Soil Science. Tata McGraw Hill publishing Co. Ltd, New Delhi
6. Brady, N.C. and Weil, R.R. 2002. The Nature and Properties of Soils. Prentice Hall of India Pvt. Ltd, M-97, Connaught Circus, New Delhi

Paper Code	Course Title	L	T	P	Cr
AGS 224	Manures, Fertilizers and Soil Fertility Management	2	0	2	3

Course Objectives: To provide knowledge to students about organic manures, fertilizer recommendation approaches, integrated nutrient management, soil fertility and plant nutrition, soil fertility evaluation and methods of fertilizer application.

Theory

UNIT I

History of soil fertility and plant nutrition. Criteria of essentiality, role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients.

UNIT II

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring.

UNIT III

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, Fertilizer Storage, Fertilizer Control Order.

UNIT IV

Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis and rapid plant tissue tests. Indicator plants. Formulation of fertilizer recommendations to crops. Nutrient use efficiency (NUE): Concepts and factors influencing it, methods of application under rainfed and irrigated conditions.

Practical

Introduction of analytical instruments and their principles, calibration and applications, Colorimetry and flame photometry. Estimation of soil organic carbon, Estimation of alkaline hydrolysable N in soils. Estimation of soil extractable P in soils. Estimation of exchangeable K; Ca and Mg in soils. Estimation of soil extractable S in soils. Estimation of DTPA extractable Zn in soils. Estimation of N in plants. Estimation of P in plants. Estimation of K in plants. Estimation of S in plants.

Suggested Readings:

1. Basak, R.K. 2000. Fertilizers, Kalyani Publishers, Ludhiana
2. Mehra R.K. 2004. Text book of Soil Science, ICAR New Delhi
3. Tisdale, S.L. Nelson, W.L. Beaton, J.D. and Havlin, J.L. 1991. Soil fertility and fertilizers. Prentice Hall of India, Pvt. Ltd, New Delhi.

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4. Yawalkar, K.S. and Agarwal. J.P. 1992. Manure and fertilizers. Agriculture- Horticulture Publishing House, Nagpur.
5. Chopra, S.L. and Kanwar, J.S. 1991. Analytical Agriculture, Chemistry, Kalyani Publishers, New Delhi.

6. Paper Code	Course Title	L	T	P	Cr
AGS 312	Problematic Soils and their Management	2	0	0	2

Course Objectives: To provide knowledge and understanding to the agriculture graduates about soil quality and health, waste land and problem soils in India, reclamation and management, irrigation water, remote sensing and GIS in diagnosis and management of problem soils and bioremediation.

Theory

UNIT I

Soil quality and health, Distribution of Waste lands and problematic soils in India. Their categorization based on properties. Problematic soils under different Agro-ecosystems.

UNIT II

Reclamation and management of problematic soils: Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded and water-logged soils, Polluted soils.

UNIT III

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

UNIT IV

Multipurpose tree species, bio-remediation through MPTs of soils, land capability and classification, land suitability classification.

Suggested Readings:

1. Bear F.E. 1964. Chemistry of the Soil. Oxford & IBH.
2. Jurinak J.J. 1978. Salt-affected Soils. Department of Soil Science & Biometeorology. Utah State Univ.
3. USDA. 1954. Diagnosis and Improvement of Saline and Alkali Soils. Oxford & IBH.
4. ISSS. 2009. Fundamentals of Soil Science. Division of Soil Science, IARI, New Delhi
5. Cirsan Paul, J. 1985. Principles of remote sensing. Longman, New York.
6. Richards, L.A. 1954. Diagnosis and improvement of saline and alkali soils. USDA Hand book No. 60, Washington, DC USA.

IV ENTOMOLOGY

Paper Code	Course Title	L	T	P	Cr
AGS 124	Fundamentals of Entomology	3	0	2	4

Course Objectives: To provide knowledge about entomology, class insecta, insect morphology and insect ecology, categories of pests, IPM, pest surveillance and pest forecasting, insect systematics.

Theory

UNIT 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 molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

UNIT II

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance.

UNIT III

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.

UNIT IV

Categories of pests. Concept of IPM, practices, scope and limitations of IPM. Classification, toxicity and formulations of insecticides. Chemical control-importance, hazards and limitations. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation. Insecticides Act 1968-Important provisions. Application techniques of spray fluids. Symptoms of poisoning, first aid and antidotes.

Practical

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. 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. Sampling techniques for estimation of insect population and damage.

Suggested Readings:

1. Mani, M.S. 1973. General Entomology. Oxford & I.B.H. Pub. New Delhi.
2. David, B.V. and Ananthakrishnan, T.N. 2006. General and applied Entomology. Second Edition. Tata McGraw Hill, New Delhi
3. Nayar, K.K., Ananthakrishnan, T.N., and David, V.B. 1976. General and applied entomology, Tata McGraw-Hill
4. Raghunathy, K.N, Balasubramany, V. Srinivasan, M.R. and Natrajan, N. 2006. Insecta- An Introduction. A.E. Publication, Coimbatore.
5. Dhaliwal, G.S. and Ramesh Arora. 2003. Integrated pest management: concepts and approaches. Kalyani Publishers, Ludhiana,

Paper Code	Course Title	L	T	P	Cr
AGS 313	Pests of Crops and Stored Grains and their Management	2	0	2	3

Course Objectives: To enlighten students about nature and type of damage caused by different arthropods pests, their systematic and management of major pests of field, vegetable, fruit, plantation and ornamental crops, spices and condiments, losses and deterioration of stored grains, storage structure and principles of grain store management.

Theory

UNIT I

General account on nature and type of damage by different arthropod 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 other important arthropod pests of various crops: field crop.

UNITII

General account on nature and type of damage by different arthropod 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 other important arthropod pests of various crops: vegetable crop, fruit crop, plantation crops.

UNIT III

General account on nature and type of damage by different arthropod 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 other important arthropod pests of various crops: ornamental crops, spices and condiments.

UNIT IV

Storage structure and methods of grain storage and fundamental principles of grain store management, 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 micro-organisms associated with stored grain and their management.

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, narcotics, spices & condiments. Identification of insect pests and mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations of the doses of insecticides and application techniques. 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 Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

Suggested Readings:

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

Paper Code	Course Title	L	T	P	Cr
AGS 324	Management of Beneficial Insects	1	0	2	2

Course Objectives: To provide knowledge of beneficial insects, bees, silkworm, lac insect, identification of major parasitoids and predators commonly used in pest control and their mass multiplication techniques, identification of other important pollinators, weed killers and scavengers.

Theory

UNIT I

Beneficial Insects and their Importance, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, their enemies and diseases. Bee pasturage, foraging and communication. Role of pollinators in crop plants.

UNIT II

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.

UNIT III

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Identification of major parasitoids and predators commonly being used in biological control.

UNIT IV

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

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.

Suggested Readings:

1. DeBach, P. 1974. *Biological Control by Natural Enemies*. Cambridge University Press.
2. Dhaliwal G.S. & Arora, R. 2001. *Integrated Pest Management: Concepts and approaches*. Kalyani Publ., New Delhi.
3. Dhaliwal, G.S. & Koul, O. 2007. *Biopesticides and Pest Management*. Kalyani Publ., New Delhi.
4. Manfred Mackaur, Laster E.Ehler and Jens Roland. 1990. *Critical Issues in Biological control*- Intercept Ltd. Project Directorate of Biological control. 1994. *Technology for mass production of Natural enemies*. Technical Bulletin -4.
5. Abrol, D.P. 2013. *Beekeeping: A Comprehensive Guide to Bee and Beekeeping*. Scientific Publishers, Jodhpur.

V AGRICULTURAL ECONOMICS

Paper Code	Course Title	L	T	P	Cr
AGS 112	Fundamentals of Agricultural Economics	2	0	0	2

Course Objectives: To provide an understanding of economic analysis, basic concepts, agricultural economics, demand, production, laws of returns, cost, supply, market structure, national income, population, money, banking, agricultural and public finance, taxes and economic systems.

Theory

UNIT I

Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, positive and normative analysis. 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. Economic growth and economic development: basic concept, indicators and measurements. Agricultural planning and development in the country.

UNIT II

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. *Laws of returns:* Law of variable proportions and law of returns to scale. *Cost:* Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.

UNIT III

Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. 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.

UNIT IV

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. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, 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.

Suggested Readings:

1. Amarjeet S. 2015. Fundamentals of Agricultural Economics. Himalaya Publishing House, New Delhi
2. H.L. Ahuja. 2016. Macroeconomics: Theory and Policy. S. Chand and company
3. H.L. Ahuja. 2016. Principles of Microeconomics. S. Chand Publishing
4. Memoria, C.B. and B.B. 2007. Agricultural Problems in India. Kitab Mahal. Allahabad
5. S.S. Reddy. 2015. Agricultural Economics. Oxford & IBH Publishers

Paper Code	Course Title	L	T	P	Cr
AGS 213	Agricultural Finance and Co-operation	2	0	2	3

Course Objectives: To acquaint students about agricultural finance, agricultural credit, credit analysis, sources of agricultural finance, micro and macro financing institutions, preparation and analysis of financial statements and agricultural cooperation.

Theory

UNIT I

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, 7P's and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks. Supervisory credit systems, priority lending.

UNIT II

Social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. e-banking. 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.

UNIT III

Preparation and analysis of financial statements – Balance Sheet, cash flow statement, and Income Statement. Repayment plans, Basic guidelines for preparation of project reports- Bank norms – SWOT analysis. Agricultural Cooperation: Meaning, brief history of cooperative development in India, objectives. Project appraisal techniques: Discounted and undiscounted measures.

UNIT IV

Principles of cooperation, significance of co-operatives 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

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

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sheet – A case study. Preparation and analysis of financial 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.

Suggested Readings:

1. N. K. Jain. 2012. Agricultural Finance. Pragun Publication.
2. Rahul B. Nagpal. 2017. Agricultural Finance. Pacific Books International.
3. S.S. Reddy & P. Raghu Ram. 2017. Agricultural Finance and Management. Oxford & IBH, Publishers.
4. Vikram Sharma. 2014. Agricultural Finance and Management. Random Publications.

Paper Code	Course Title	L	T	P	Cr
AGS 227	Agricultural Marketing, Trade and Prices	2	0	2	3

Course Objectives: To teach students about agricultural marketing, product life cycle and competitive strategies, pricing and promotional strategies, marketing process and functions, marketing channels, integration, efficiency, costs and price spread, role of Govt. in agricultural marketing, agricultural prices and policy and trade.

Theory

UNIT I

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities.

UNIT II

Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – 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.

UNIT III

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.

UNIT IV

Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; e-NAM, cooperative marketing in India, corporate and contract farming. 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. Supply chain and value chain.

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.

Suggested Readings:

1. Ramkishen Y. 2002. New Perspectives in Rural & Agricultural Marketing. Jaico Publishing House
2. S.S. Acharya. 2017. Agricultural Marketing in India. Oxford & IBH; PB edition
3. S.S. Chhina. 2009. Agricultural Marketing in India. Kalyani Publishers

Paper Code	Course Title	L	T	P	Cr
AGS 328	Farm Management, Production and Resource Economics	1	0	2	2

Course Objectives: To acquaint students with concept and principles of farm management, farm business analysis, farm planning and budgeting, crop/livestock/machinery insurance and concepts of resource economics.

Theory

UNIT I

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.

UNITII

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, cash flow statement, profit and loss accounts.

UNITIII

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.

UNITIV

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. climate change, mitigation and policies, environmental regulations, green GNP, policy options for sustainable agriculture.

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.

Suggested Readings:

1. Dhaka, J. M. 2010. Economics of Agricultural Production and Farm Management. Aavishkar
2. Dhondyal, S. P. 2012. Farm Management: Economic Approach. Aman Publishing House.
3. Raju, V.T., 2017. Economics of Farm Production and Management. Oxford & IBH Publishing Co Pvt. Ltd

VI AGRICULTURAL ENGINEERING

Paper Code	Course Title	L	T	P	Cr
AGS 214	Farm Machinery and Power	1	0	2	2

Course Objectives: To teach students about status of farm power in India, sources of farm power, I.C. engines and familiarization with different systems of I. C. engines, tractor types and cost analysis of tractor power, familiarization with sowing and planting equipments

Theory

UNIT I

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.

UNIT II

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.

UNIT III

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.

UNIT IV

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 like happy seeder *etc.*

Practical

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

Suggested Readings:

1. Nakra, C.P. 2009. Farm machines and equipment. Dhanpat Rai Publishing Company, New Delhi,
2. Srivastava, A.C. and Primlari, R. 2008. Elements of Farm Machinery. Oxford & IBH Publishing Company, New Delhi

3. Jain, S.C. and Rai, C.R. 2008. Farm Tractor-maintenance and repair. Standard Publishing Distributers, New Delhi

Paper Code	Course Title	L	T	P	Cr
AGS 223	Renewable Energy and Green Technology	1	0	2	2

Course objectives: To provide working knowledge and awareness about classification of energy sources, their contribution in agricultural sector, introduction and application of solar energy, familiarization with solar energy gadgets.

Theory

UNIT I

Classification of energy sources, contribution of these of sources in agricultural sector, familiarization with biomass utilization for biofuel production and their application.

UNIT II

Familiarization with types of biogas plants and gasifies bio-gas, bio-alcohol, bio-diesel and bio-oil production and their utilization as bio-energy resource.

UNIT III

Introduction to solar energy, collection and their application, familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy.

UNIT IV

Solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction to wind energy and their application.

Practical

Familiarization with renewable energy gadgets. To study bio-gas plants, to study gasifier, to study the production process of bio-diesel, 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.

Suggested Readings:

1. Tiwari, G. N. and Mishra Rajeev Kumar. 2012. Advanced Renewable Energy Sources. Royal Society of Chemistry

Paper Code	Course Title	L	T	P	Cr
AGS 228A	Soil and Water Conservation Engineering	1	0	2	2

Course Objectives: To teach students about soil and water conservation, forms, causes and control of soil, water and wind erosion.

Theory

UNIT I

Introduction to soil and water conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion, forms of water erosion.

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UNIT II

Stages of soil erosion. Gully: classification and control measures. Soil loss estimation by Universal Soil Loss Equation (USLE). Soil loss measurement techniques.

UNIT III

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.

UNIT IV

Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion 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.

Suggested Readings:

1. Nakra, C.P. 2009. Farm machines and equipment, Dhanpat Rai Publishing Company, New Delhi,
2. Srivastava, A.C. and Primlari, R. 2008. Elements of Farm Machinery, Oxford & IBH Publishing Company, New Delhi
3. Jain, S.C. and Rai, C.R. 2008. Farm Tractor-maintenance and repair, Standard Publishing Distributers, New Delhi

Paper Code	Course Title	L	T	P	Cr
AGS321	Protected Cultivation and Secondary Agriculture	1	0	2	2

Course objectives: To teach students about green house technology, irrigation systems used in green houses, cost estimation and economic analysis, important engineering properties, drying and dehydration and material handling equipments.

Theory

UNIT I

Green house technology: Introduction, Types of Green Houses; Plant response to greenhouse 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.

UNIT II

Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis.

UNIT III

Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.

UNIT IV

Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

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

Suggested Readings:

1. Panday P.H. 2015. Principles and Practices of Post-Harvest Technology. Kalyani Publishers
2. Verma L.R. and Joshi V.K. 2000. Post-Harvest Technology of Fruits and Vegetables Indus Publishing
3. Girdharilal G.S. Sidhappa and Tondan G.L. 2009. Fruits and Vegetable preservation.
4. Prasad S. and Kumar U.2005. Green house management for Horticultural Crops, Agrobio (India)
5. Chakraverty A. Post-Harvest Technology of Cereals, Pulses and Oilseeds.2008. Oxford & IBH Publishing Co. Pvt. Ltd.

VII PLANT PATHOLOGY

Paper Code	Course Title	L	T	P	Cr
AGS 212	Fundamentals of Plant Pathology	3	0	2	4

Course Objectives: To teach students about plant diseases, cause and classification of plant diseases, pathogenic organisms such as fungi, bacteria, mollicutes, viruses and nematodes and their classification

Theory

UNIT I

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

UNIT II

Fungi: General characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.

Bacteria and Mollicutes: General morphological characters. Basic methods of classification and reproduction.

UNIT III

Viruses: Nature, architecture, multiplication and transmission. Study of phanerogamic plant parasites.

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

UNIT IV

Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

Acquaintance with various laboratory equipments and microscopy. Collection and preservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites. Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

Suggested Reading:

1. Agrios, G.N. 1998. Plant Pathology, 3rd Edition Academic Press, New York.

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- Alexopolus, C.J. and Mims. 1989. Introductory Mycology, Willey Eastern Ltd., New Delhi.
- Alice, D., C. Jayalakshmi and K. Sethuraman. 2007. Hand Book on Introductory Plant Pathology, A.E. Publication, Coimbatore.
- Mehrotra, R.S. 1990. An Introduction to Mycology, Willey Eastern Ltd., New Delhi.
- Narayanasamy, P. 1997. Plant Pathogens and Disease Control Oxford and IBH Publishing Co. Ltd, New Delhi.
- Ciancio, A. and Mukerji, K.G. eds., 2007. General concepts in integrated pest and disease management. Springer.

Paper Code	Course Title	L	T	P	Cr
AGS 314	Diseases of Field & Horticultural Crops & their Management-I	2	0	2	3

Course Objectives: To teach students symptoms, etiology, disease cycle and management of major diseases of field crops, fruit crops and vegetable crops.

Theory

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

UNIT I

Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra: downy mildew and ergot; Groundnut: tikka disease and wilt.

UNIT II

Soybean: *Rhizoctonia* blight, bacterial spot, seed and seedling rot and mosaic; Pigeon pea: *Phytophthora* blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: *Cercospora* leaf spot and anthracnose, web blight and yellow mosaic; Castor: *Phytophthora* blight; Tobacco: black shank, black root rot and mosaic.

UNIT III

Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: *Alternaria* leaf spot and black rot.

UNIT IV

Brinjal: Phomopsis blight and fruit rot and *Sclerotinia* blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: *Phytophthora* blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and well-mounted specimens.

Suggested Readings:

1. Thind, T.S. 2005. Diseases of field crops and their management. Daya Books.
2. Gupta, V.K. & Sharma S.K. 2000. Diseases of Fruit Crops. Kalyani Publ., New Delhi.
3. Verma, L.R. and Sharma, R.C. 1999. Diseases of horticultural crops: vegetables, ornamentals, and mushrooms. Indus Publishing.
4. Singh, R.S. 2000. Diseases of Fruit Crops. Oxford & IBH, New Delhi.
5. Walker, J.C. 2004. Diseases of Vegetable Crops. TTPP, India.
6. Gupta, S.K and Thind, T.S. 2012. Disease problems in vegetable production. Scientific Publishers India

Paper Code	Course Title	L	T	P	Cr
AGS 322	Diseases of Field & Horticultural Crops & their Management-II	2	0	2	3

Course Objectives: To teach students about the symptoms, etiology, disease cycle and management of field crops, sugarcane, strawberry, potato, cucurbits.

Theory

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

UNIT I

Field Crops: Wheat: rusts and smuts, powdery mildew, *Alternaria* blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and pokkah boeng.

UNIT II

Sunflower: *Sclerotinia* stem rot and *Alternaria* blight; Mustard: *Alternaria* blight, white rust, downy mildew and *Sclerotinia* stem rot; Gram: wilt, grey mould and *Ascochyta* blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

UNIT III

Horticultural Crops: Mango: anthracnose, malformation, bacterial blight and powdery mildew; *Citrus*: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl.

UNIT IV

Strawberry: leaf spot Potato: early and late blight, black scurf, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and *Stemphylium* blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Turmeric: leaf spot Coriander: stem gall Marigold: *Botrytis* blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium. ELISA and PCR.

Note: Students should submit 50 pressed and well-mounted specimens.

Suggested Readings:

1. Rangaswami, G. and Madhwan, A. 1998. Diseases of crop plants in India PHI Learning Pvt. Ltd.
2. Thind, T.S. 2007. Diseases of field crops and their management. Daya Books.
3. Gupta, V.K. & Sharma, S.K. 2000. Diseases of Fruit Crops. Kalyani Publ., New Delhi.
4. Verma, L.R. and Sharma, R.C. 1999. Diseases of horticultural crops: vegetables, ornamentals, and mushrooms. Indus Publishing.
5. Singh R.S. 2017. Diseases of Fruit Crops. Medtech Publishers.
6. Walker J.C. 1952. Diseases of Vegetable Crops. TTPP, India.
7. Gupta, S.K. and Thind, T.S. 2012. Disease problems in vegetable production, Scientific Publishers India.
8. Gupta, S. K., Sharma, S. C. and Sharma Monica. 2017. Diseases of ornamental and spice crops. Scientific Publishers, Jodhpur.

Paper Code	Course Title	L	T	P	Cr
AGS 311	Principles of Integrated Pest and Disease Management	2	0	2	3

Course Objectives: To teach students about the categories of insect pests and diseases, IPM, economic threshold level, methods of control, conventional pesticides for pest and disease management, implementation and impact of IPM, safety issues in pesticide uses.

Theory

UNIT I

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Trans- boundary pest and disease.

UNIT II

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. Ecological management of crop environment.

UNIT III

Introduction to conventional pesticides for the insect pests and disease management. Survey, surveillance and forecasting of Insect pests and diseases. Development and validation of IPM module.

UNITIV

Implementation and impact of IPM (IPM module for Insect pest and disease). Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes.

Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations

based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of *Trichoderma*, *Pseudomonas*, *Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making, crop monitoring attacked by insect, pest and diseases. Awareness campaign at farmers fields.

Suggested Readings:

1. Ciancio, A. and Mukerji, K.G. eds. 2007. General concepts in integrated pest and disease management. Springer.
2. Abrol, D.P. and Shankar, U. eds. 2012. Integrated pest management: principles and practice. CABI.
3. Nene, Y.L. and Thapliyal, P.N. 1993. Fungicides in plant disease control. International Science Publisher.
4. Chattopadhyay, S.B. 1980. Principles and procedures of plant protection. Oxford & IBH Publishing Company.

VIII HORTICULTURE

Paper Code	Course Title	L	T	P	Cr
AGS 125	Fundamentals of Horticulture	1	0	2	2

Course Objective: This is a basic course on horticulture, which will enlighten the students with the new areas in horticulture and acquaint them with the broad field of horticulture including various horticultural tools, layout, canopy management, nutrition and usage of plant hormones.

Theory

UNIT I

Horticulture – History of horticulture, Punjab Horticulture, Institutes of Horticulture. Its definition and branches, importance and scope, horticultural and botanical classification.

UNIT II

Climate and soil for horticultural crops; Plant propagation-methods and propagating structures. Seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy.

UNIT III

Kitchen gardening; garden types (Hindu, Japanese, Persian, Moghul, Italian, Mediaeval, French, British) and pots; lawn making.

UNIT IV

Importance of plant bio-regulators in horticulture. Irrigation – methods, fertilizer and biofertilizer application in horticultural crops.

Practical

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

Suggested Readings:

1. Singh, Jitendra. 2016. Basic Horticulture. Kalyani Publishers
2. Bose, U. S. 2012. Fundamentals of Horticulture Oxford Book Company
3. Singh, Jitendra. 2017. Fundamentals of Horticulture Kalyani Publisher
4. Chhipa, B.G. 2018. Fundamentals of Horticulture Agrotech Publishing Academy

2. Paper Code	Course Title	L	T	P	Cr
AGS 225	Production Technology for Fruit and Plantation Crops	1	0	2	2

Course Objective: To provide knowledge regarding economic importance, varietal wealth and scientific package of practices for various fruit and plantation crops.

Theory

UNIT I

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

UNIT II

Production technologies for the cultivation of stone fruits, walnut, almond.

UNIT III

Production technologies for the cultivation of minor fruits- date, ber, pineapple, pomegranate, jackfruit, small berry fruits.

UNIT IV

Production technologies for the cultivation of plantation crops-coconut, arecanut, cashew, tea, coffee & rubber and integrated farming system with plantation crops and spices.

Practical

Seed propagation. Scarification and stratification of seeds. Propagation methods for fruit and plantation crops. Description and identification of fruit. Preparation of plant bio regulators and their uses, important pests, diseases and physiological disorders of above fruit and plantation crops, Visit to commercial orchards.

Suggested Readings

1. Chadha, K. L. 2020. Hand book of Horticulture. ICAR.
2. Bal, J. S. 2014. Fruit growing. 3rd edition Kalyani Publishers.
3. Kumar, N. 2016. Introduction to spices, plantation crops, medicinal and aromatic plants. Oxford & IBH Publishing Co Pvt. Ltd.
4. Chattopadhyay, T. K. 2015. A textbook of Pomology. Vol II. Tropical Fruits. Kalyani Publishers.
5. Chattopadhyay, T. K. 2015. A textbook on Pomology. Vol III. Subtropical fruits. Kalyani Publishers.
6. Chattopadhyay, T. K. 2015. A textbook on Pomology. Vol IV. Temperate fruits. Kalyani Publishers.

Paper Code	Course Title	L	T	P	Cr
AGS 216	Production Technology for Vegetable and Spices	1	0	2	2

Course Objectives: To make students aware of package of practices of growing important vegetables and spices

Theory

UNIT I

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, plant spacing, fertilizer requirements,

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irrigation, weed management, harvesting and yield, physiological disorders of Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin.

UNIT II

Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, plant spacing, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of Okra, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol.

UNIT III

Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, plant spacing, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders of Bulb crops such as Onion, Garlic; Root crops such as Carrot, Radish, Ginger and Turmeric.

UNIT IV

Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, sowing, transplanting techniques, plant spacing, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important spices, Tuber crops: Potato; Leafy vegetables such as Amaranth, Palak.

Practical

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

Suggested Readings:

1. Dhaliwal M.S. 2008. Handbook of vegetable crops, Kalyani Publishers, Ludhiana.
2. Das, P.C. 1993. Vegetable crops of India, Kalyani Publishers, Ludhiana.
3. Chauhan, D.V. 1993. Vegetable production in India, S. Ram Prasad and Sons, Agra.
4. Package of Practices for Vegetable crops, P.A.U. Publications Ludhiana, Corresponding year.
5. Purthy, J.S. 1996. Spices and Condiments. National Book Trust.

Paper Code	Course Title	L	T	P	Cr
AGS 222	Production Technology for Ornamental Crops, MAPs and Landscaping	1	0	2	2

Course Objectives: To make students aware of package of practices of growing important ornamental crops, medicinal and aromatic plants. The students will be acquainted with basic principles of landscaping.

Theory

UNIT I

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation.

UNIT II

Production technology of important cut flowers like liliun and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine.

UNIT III

Production technology of important medicinal plants like ashwagandha, asparagus, aloe, Cinnamomum, isabgol.

UNIT IV

Production technology of important aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, Processing and value addition in ornamental crops and MAPs produce.

Practical

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

Suggested Readings:

1. Arora, J.S. 2010. Introductory ornamental horticulture. Kalyani Publishers.
2. Swarup Vishnu. 1997, Ornamental horticulture. MacMillan India Ltd.
3. Raj Desh. 2011. Floriculture at Glance. Kalyani Publishers.

Paper Code	Course Title	L	T	P	Cr
AGS 323	Post-harvest Management and Value Addition of Fruits and Vegetables	1	0	2	2

Course Objectives: To teach about importance of fruits and vegetables, extent and possible causes of post harvest losses, harvesting and field handling, storage, value addition concept, principles and methods of preservation, drying/ dehydration of fruits and vegetables, canning.

Theory

UNIT I

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity standards, ripening and changes occurring during ripening, use of growth regulators for ripening.

UNIT II

Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept.

UNIT III

Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy – Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and Standards.

UNIT IV

Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. Canning – Concepts and Standards, packaging of products.

Practical

Applications of different types of packaging, containers for shelf-life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/ industry.

Suggested Readings:

1. Panday P.H. 2015. Principles and Practices of Post-Harvest Technology. Kalyani Publishers
2. Verma L.R. and Joshi V.K. 2000. Post-Harvest Technology of Fruits and Vegetables Indus Publishing
3. Sudheer K.P. 2007. Post-Harvest Technology of Horticultural Crops New India Publishing Agency
4. Mir M.A. 2007. Post-Harvest Management of Horticultural Crops Agrotech Publishing Academy
5. Girdharilal, Sidhappa G.S. and Tondan, G.L. 1967. Fruits and Vegetable preservation Indian Council of Agricultural Research

IX FOOD SCIENCE & TECHNOLOGY

Paper Code	Course Title	L	T	P	Cr
AGS 329	Principles of Food Science and Nutrition	2	0	0	2

Course Objectives: To provide student knowledge about the concepts of food science, food composition and chemistry, food microbiology, principles and methods of food processing and preservation, food and nutrition.

Theory

UNIT I

Concepts of Food Science: definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc..

UNIT II

Food composition and chemistry: water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bio-actives, important reactions.

UNIT III

Food microbiology: bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods. Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.);

UNIT IV

Food and nutrition: Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, new trends in food science and nutrition.

Suggested Readings:

1. Srilakshmi, B. 2010. Text Book of Food Science. New age international (P) limited, publisher, New Delhi
2. Sehgal, S. and Raghuvanshi, R.S. 2007. Text Book of Community Nutrition, ICAR Publication.
3. Khaddar V. 1999. Text Book of Food. Storage and Preservation. Kalyani Publishers, New Delhi.
4. Srilakshmi, B. 2010. Text Book of Nutrition Science. New age international (P) limited, publisher, New Delhi.
5. Swaminathan. M. 1993. Advanced Textbook on Food and Nutrition. Volume I, Bappco, the Bangalore Press and Publishing Co. Ltd. Bangalore.

X AGRICULTURAL EXTENSION AND COMMUNICATION

Paper Code	Course Title	L	T	P	Cr
AGS 114	Communication Skills and Personality Development	1	0	2	2

Course Objectives: To develop communication skills, listening and reading and comprehension, writing, individual and group presentations, organization of group discussion, seminars and conferences.

Theory

UNIT I

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication;

UNIT II

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.

UNIT III

Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting;

UNIT IV

Individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations.

Suggested Readings:

1. Sandhu, A. S. 1999. Textbook on Agricultural Communication; process and methods. Oxford & IBH Publishing co. Pvt. Ltd. New Delhi.
2. Berlo, David K. 1960. The process of Communication. New York, Holt, Rinehart and Winston Inc.
3. Dahama, O. P. and Bhatnagar, O.P. 1998. Education and Communication for Development, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
4. Jalihal, K. A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension, Concept publishing company, New Delhi.
5. Ray, G. L. 1991. (1st Edition), Extension Communication and Management, Kalyani Publishers, Ludhiana {7th revised edition - 2010}.
6. Supe, S. V. 2013. (2nd Edition), A Text Book of Extension Education, Agrotech Publishing Academy, Udaipur.
7. Hilaris, M. 2011. Indian agriculture and information and communication technology (ICT): Soundari. New century Publications, Carnegie,

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Paper Code	Course Title	L	T	P	Cr
AGS 122	Fundamentals of Agricultural Extension Education	2	0	2	3

Course Objectives: To teach students about principles of extension education, extension programme, extension systems in India, rural development, rural leadership, extension administration, monitoring and evaluation, extension teaching methods and agriculture journalism

Theory

UNIT I

Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development.

UNIT II

Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, NAHEP etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, SAMETI/ PAMETI market-led extension, farmer-led extension, expert and decision support systems, RAWE, student READY, Farmer first programme, etc. pluralistic extension.

UNIT III

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel.

UNIT IV

Extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and social media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

Practical

To get acquainted with university extension systems and KVK. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids, mobile apps preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience

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in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

Suggested Readings:

1. Mondal, S. and Ray G.L. 2007. A Text book of Rural Development. Kalyani Publishers, Chennai
2. Dharma, O.P. and Bhatnagar, O.P. 2003. Education and Communication for Development. Oxford, IBH, New Delhi
3. Desai, A.R. 2003. Rural Sociology in India. Popular Prakashan, Bombay
4. Samanta, R.B. 1991. Agricultural Extension in Changing World perspective. UDH Publishing, New Delhi
5. Ray G.L. 2007. Extension Communication and Management, Kalyani Publishers, Chennai

Paper Code	Course Title	L	T	P	Cr
AGS 219	Rural Sociology & Educational Psychology	2	0	0	2

Course Objectives: To teach students about sociology and rural sociology, rural society and culture, social stratification and institutions, social change and development, educational psychology, behaviour, motivation and intelligence.

Theory

UNIT I

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology, Rural society, Social Groups.

UNIT II

Social Stratification, Culture concept, Social Institution, Social Change & Development.

UNIT III

Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective.

UNIT IV

Psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

Suggested Readings:

1. Chitambar, J.B. 2002. Introductory Rural Sociology, Wiley Eastern Private Limited, New Delhi
2. Dahama O.P. and Bhatnagar, O.P. 2003, Education and communication for development, Oxford and IBH Publishing Co. New Delhi
3. Desai, A.R. 1994. Rural Sociology in India, Popular Prakashan, Bombay
4. Mangal S.K. 2006. Essentials of Education Psychology. Prentice Hall India Learning Private Limited

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Paper Code	Course Title	L	T	P	Cr
AGS 316	Entrepreneurship Development and Business Communication	1	0	2	2

Course Objectives: To provide knowledge about concept of entrepreneur, entrepreneurship development, impact of economic reforms on agribusiness/agri enterprises, developing managerial skills and business leadership skills, project planning, formulation and report preparation

Theory

UNIT I

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development.

UNIT II

Impact of economic reforms on Agribusiness/ Agri enterprises, Entrepreneurial Development Process; Business Leadership Skills; developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation).

UNIT III

Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management, value chain, block chain and Total quality management, sales promotion techniques.

UNITIV

Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agri-entrepreneurship and rural enterprise. Incubators and start-ups.

Practical

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

Suggested Readings:

1. Anil Kumar, S., Poornima, S.C., Mini, K., Abraham and Jayashree, K. 2016. Entrepreneurship Development, New Age International Publishers, New Delhi.
2. Mary Coulter. 2015. Entrepreneurship in Action. Prentice Hall of India Pvt. Ltd., New Delhi.
3. Mohanty, S.K. 2005. Fundamentals of Entrepreneurship. Prentice Hall of India Pvt. Ltd.

XI BIOCHEMISTRY/ PHYSIOLOGY/ MICROBIOLOGY/ ENVIRONMENTAL SCIENCES

Paper Code	Course Title	L	T	P	Cr
AGS 126	Fundamentals of Plant Biochemistry and Biotechnology	2	0	2	3

Course Objectives: To teach students about basic of biochemistry of macromolecules like DNA, RNA, Proteins, Carbohydrates, fats etc. To teach students about basic plant tissue culture and DNA fingerprinting techniques.

Theory

UNIT I

Biochemistry: Introduction and importance. Properties of Water, pH and Buffer. Plant cell and Cell wall. Bio-molecules; Structure, properties & applications. Amino acids, peptides, proteins and their quality. Enzymes: Enzyme kinetics, Factors affecting the activity, classification, immobilization and other industrial applications. Lipids, Carbohydrates, Nucleotides and Nucleic acids.

UNIT II

Metabolism: Basic concepts, Glycolysis, Citric acid Cycle, oxidative phosphorylation. Biosynthesis: Carbohydrates, Lipids, Proteins and Nucleic acids. Metabolic regulation.

UNIT III

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Recombinant DNA Technology; Scope and importance in Crop Improvement. Concepts of Totipotency, Plasticity and Morphogenesis. *In-vitro* cultures: Nutritional requirements, Techniques of *in-vitro* cultures, Micro propagation; Somatic embryogenesis and synthetic/artificial seed production technology. Anther/microspore/Pollen culture, Ovule culture, Embryo culture, Endosperm culture, Factors affecting *in-vitro* culture; Applications and Achievements.

UNIT IV

Somaclonal variation: Types, Reasons and molecular basis. Protoplast: isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement. Genetic engineering by Recombinant DNA Technology: Restriction enzymes, Vectors for gene transfer, Gene cloning, Direct and indirect method of gene transfer, Selectable and Scorable markers; GUS, GFP and LacZ etc., Transgenic plants and their applications. DNA finger printing: DNA markers; DNA Probes, RFLP, AFLP, RAPD and SSR, NGS based markers (SNPs). Applications and prospects of DNA Markers in crop improvement through QTL mapping and MAS. Genome editing (CRISPR/Cas9), Importance of bioinformatics.

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques. Composition of various tissue culture media and preparation of

stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization. Demonstration on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

Suggested Readings:

1. Buchanan B. B., Gruissen, W. and R.L. Jones R.L. 2015. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, USA.
2. Chawla, H.S. 2009. Plant Biotechnology. Oxford and IBH Publishing.
3. Goodwin, T.W., and Mercer, E.I. 2005. Introduction to Plant Biochemistry. 2nd Edition, Pergamon Press, Oxford.
4. Nelson, D.L. and Cox, M.M. Lehninger. 2013. Principles of Biochemistry. 6th Edition, Freeman, W. H. Freeman & Company.
5. Singh, B.D. and Shrivastva, J.P. 2011. Plant Tissue Culture & Plant Biotechnology. Kalyani Publisher.
6. Singh, B.D. 2014. Plant Biotechnology, Kalyani Publisher.
7. Slater, A., Scott, N. W. and Flower R. 2003 Plant Biotechnology: The genetic manipulation of plants. Oxford Publications.

Paper Code	Course Title	L	T	P	Cr
AGS 123	Fundamentals of Crop Physiology	1	0	2	2

Course Objectives: To provide students an understanding of plant cell, diffusion and osmosis, mineral nutrition of plants, photosynthesis, respiration, fat metabolism, plant growth regulators and physiological aspects of growth and development of major crops.

Theory

UNIT I

Introduction to crop physiology and its importance in Agriculture; Plant cell: an overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology.

UNIT II

Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants.

UNIT III

Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown.

UNIT IV

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).

Suggested Readings:

1. Mohr, H. and Schopfer, P. 2012. Plant Physiology. Springer Science & Business Media.
2. Nobel, P. 2012. Physicochemical and Plant Physiology. Academic Press.
3. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology, 4th Edition, Wadsworth Publishing Company.
4. Steward, F.C. 2012. Plant Physiology: A Treatise: Growth and Development. Academic Press.
5. Taiz, L. and Zeiger, E. 2010. Plant Physiology, 5th Edition, Sinauer Associates.

Paper Code	Course Title	L	T	P	Cr
AGS 121	Agricultural Microbiology	1	0	2	2

Course objectives: To give students knowledge about microorganisms, prokaryotic and eukaryotic microbes, bacteria and bacterial genetics, role of microbes in soil fertility and crop production and role of microbes in human welfare

Theory

UNIT I

Introduction to Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.

UNIT II

Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposons.

UNIT III

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and sulphur cycles. Biofertilizers: biological nitrogen fixation- symbiotic, associative and aysmbiotic. *Azolla*, blue green algae, phosphate solubilizing bacteria (PSB) and mycorrhiza. Rhizosphere and phyllosphere. Microbiome and Metagenomics

UNIT IV

Microbes in human welfare: silage production, mushroom cultivation, *Morchella*, Single cell proteins (SCPs), bio-pesticides, antibiotics. Bio-fuel production and bio-degradation.

Practical

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

Suggested Readings:

1. Dubey, R.C., and Maheshwari, D.K. 2010. A text book of Microbiology, S. Chand & Company Ltd, New Delhi.
2. Darralyn M., David S. and Phillip A. 2001. Introduction to microbiology. Black Well Publication Ltd. USA.

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- Nicklin, J., Graeme-Cook, K. and Killington, R. 2011. Instant Notes; Microbiology, 4th Edition, BIOS Publications
- Salle, A.J. 1974. Fundamentals Principles of bacteriology. MacGraw Hill, Inc..

Paper Code	Course Title	L	T	P	Cr
EVS 212	Environmental Studies and Disaster Management	2	0	2	3

Course Objectives: To teach students about natural resources such as forest, water, mineral, energy resources etc., ecosystems, biodiversity, environmental pollution and management, social issues, population and environmental, disasters and their management.

Theory

UNIT I

Multidisciplinary nature of environmental studies: Definition, scope and importance. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems.

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

UNIT II

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

Biodiversity and its conservation: Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity.

Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III

Environmental Pollution: definition, cause, effects and control measures of:

Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards.

Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

UNIT IV

Disaster Management

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.

Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations. Vulnerability and fore-warning.

Practical

Pollution case studies. Case Studies- Field work: Visit to a local area to document environmental assets river/ forest/ grassland/ hill/ mountain, visit to a local polluted site-Urban/Rural/Industrial/Agricultural, study of common plants, insects, birds and study of simple ecosystems-pond, river, hill slopes, etc.

Suggested Readings:

1. Agrawal K.C. 2001. Fundamentals of Environmental Biology. Nidhi Publishers (India).
2. Sharma P.D. 2015. Ecology and Environment. Rastogi Publications.
3. Dhaliwal, G.S. and Kukal, S.S. 2005. Essentials of Environmental Science. Kalyani Publishers.
4. Sharma P.D. 2005. Environmental Biology and Toxicology. Rastogi Publications.

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Paper Code	Course Title	L	T	P	Cr
AGS119	Introduction to Forestry	1	0	2	2

Course Objectives: to teach students about forestry, Indian Forest Policies, forest regeneration, crown classification, forest mensuration, instrumental and non- instrumental methods of height measurement and agroforestry.

Theory

UNIT I

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration - natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations.

UNIT II

Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; Non instrumental methods of height measurement - shadow and single pole method.

UNIT III

Instrumental methods of height measurement - geometric and trigonometric principles, instruments used in height measurement; tree stem form, form factor, form quotient, measurement of volume of felled and standing trees, age determination of trees.

UNIT IV

Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region.

Practical

Identification of tree-species. Diameter measurements using calipers and tape, diameter measurements of forked, buttressed, fluted and leaning trees. Height measurement of standing trees by shadow method, single pole method and hypsometer. Volume measurement of logs using various formulae. Nursery lay out, seed sowing, vegetative propagation techniques. Forest plantations and their management. Visits of nearby forest based industries.

Suggested Readings:

1. Khanna, L. S. 1984. Principles and Practice of Silviculture. Khanna Bhandu, Dehra Dun. P. 476.
2. David M. Smith. 1989. The Practice of Silviculture. EBD Educational Pvt. Ltd. Dehradun, India.
3. Dwivedi, A.P. 1992. Agroforestry: Principles and Practices. Oxford and IBH Publication Co., New Delhi.
4. Nair, P.K.R. 1993. An introduction to agroforestry. Kluwer Academic Publishers.

XII STATISTICS, COMPUTER APPLICATION AND IPR

Paper Code	Course Title	L	T	P	Cr
AGS 217	Statistical Methods	1	0	2	2

Course Objective: To provide student acquaintance with statistics and its applications in agriculture, correlation, chi-square test, analysis of variance and introduction to sampling methods.

Theory

UNIT I

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial, Poisson & Normal distribution.

UNIT II

Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Introduction to Test of Significance, one sample & two sample test t for Means.

UNIT III

Chi-Square Test of Independence of Attributes in 2×2 Contingency Table. Introduction to Analysis of Variance, Analysis of One -Way Classification.

UNIT IV

Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample

Practical

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

Suggested Readings:

1. Agarwal, B. L. 2006. Basic Statistics. New Age International Publisher, Revised fourth edition.
2. Aggrawal, S. C. and Rana, R. K. 2007. Basis Statistics. VK publication.
3. Singh, S., Singh, T.P., Babsal, M.L. and Kumar R. 2004. Statistical Method for Research workers. Kalyani Publishers, Ludhiana.

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Paper Code	Course Title	L	T	P	Cr
CSA257	Agri-Informatics	1	0	2	2

Course Objectives: To provide basic knowledge on computers, operating systems, e-Agriculture, applications of MS-Office for creating, editing and formatting a document, MS-EXCEL, hands on Crop Simulation Models.

Theory

UNIT I

- Introduction to Computers, Study of Computer Components and accessories.
- Operating Systems, definition and types, practice of important DOS Commands. Introduction of different operating systems such as windows, Unix/ Linux.
- Creating, Files & Folders, File Management.
- Applications of MS-Office for document creation & Editing.
- Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document.

UNIT II

- e-Agriculture, concepts and applications, Use of ICT in Agriculture.
- Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops.
- Computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price.
- Postharvest management etc; Geospatial technology for generating valuable agri-information.
- Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions.
- Preparation of contingent crop-planning using IT tools.

UNIT III

- MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data.
- Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions.
- MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system.
- Introduction to World Wide Web (WWW). Introduction of programming languages
- Database, concepts and types, uses of DBMS in Agriculture.
- Introduction to computer programming languages, concepts and standard input/output operations.

UNIT IV

- Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/Wofost.
- Computation of water and nutrient requirements of crop using CSM and IT tools.

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- Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

Practical

Study of Computer Components, accessories, practice of important DOS Commands. Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management. Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document. MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW). Introduction of programming languages. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

Suggested Readings:

1. Vanitha, G. 2011. Agri informatics. New India Publishing Agency
2. Chakravarthy, R. 2006. Agri Informatics: An Introduction (Industry Series) ICFAI University Press

Paper Code	Course Title	L	T	P	Cr
AGS 319	Intellectual Property Rights	1	0	0	1

Course Objectives: To acquaint students with intellectual property, treaties for protection of IPR, types of intellectual property and legislations covering IPR in India, Patents Act 1970 and Patent system in India, introduction to UPOV for protection of plant varieties, convention on Biological Diversity.

Theory

UNIT I

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

UNIT II

Types of Intellectual Property and legislations covering IPR in India: Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.

UNIT III

Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders' rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders.

UNIT IV

Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

Suggested Readings:

1. Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw Hill.
2. Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation.
3. Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.

XIII ANIMAL PRODUCTION

Paper Code	Course Title	L	T	P	Cr
AGS 218	Livestock & Poultry Management	3	0	2	4

Course Objectives: To teach students role of livestock in the national economy, reproduction in farm animals and poultry, housing principles, management of sheep, goat and swine, digestion in livestock and poultry, introduction to livestock and poultry diseases

Theory

UNIT I

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals.

UNIT II

Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry.

UNIT III

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

UNIT IV

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

Practical

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

Suggested Readings:

1. Singh, H. 2011. Handbook of Animal Husbandry, I.C.A.R. Publications, New Delhi
2. Eigan, W.M., and Paul, R. 2005. Dairy Cattle Feed. Johan Willey & Sons, New York
3. Kumar, A. 2006. Animal Husbandry. Discovery Publishing House, New Delhi

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XIV LANGUAGE

Paper Code	Course Title	L	T	P	Cr
ENG 153B	Comprehension and Communication Skills in English	1	0	2	2

Course Objectives: To develop command on spoken English and broken English, reading comprehension, vocabulary, exercises to help the students in the enrichment of vocabulary, functional grammar and writing skills.

Theory

UNIT I

War minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw.

UNIT II

Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations.

UNIT III

Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration.

UNIT IV

Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

Practical

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

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XV REMEDIAL COURSES

Paper Code	Course Title	L	T	P	Cr
AGS 117	Agricultural Heritage	1	0	0	1

Course Objectives: To teach students about Indian agricultural heritage, scope of Agriculture and national agriculture setup in India.

Theory

UNIT I

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; past and present status of agriculture and farmers in society.

UNIT II

Journey of Indian agriculture and its development from past to modern era; Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world.

UNIT III

Agriculture scope; Importance of agriculture and agricultural resources available in India; Crop significance and classifications.

UNIT IV

National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

Suggested Readings:

1. ICAR. 2020. Handbook of Agriculture, Indian Council of Agricultural Research, New-Delhi.
2. Nene, Y.L. 2007. Glimpses of the Agricultural Heritage of India. Asian Agri- History Foundation, Secunderabad, Andhra Pradesh.
3. Nene, Y.L., Saxena, R.C. and Choudhary, S.L. 2009. A Textbook on Ancient History of Indian Agriculture. Munshiram Manoharial Publishers Pvt. Ltd.
4. Nene, Y.L., Choudhary, S.L. and Saxena, R.C. 2010. Textbook on Ancient History of Indian Agriculture. Asian Agri-History Foundation.
5. D. Kumari, Manimuthu Veeral. 2014. Text Book on Agricultural Heritage of India. Agrotech Publishing Academy.

Paper Code	Course Title	L	T	P	Cr
AGS 118	Introductory Biology	1	0	2	2

Course Objective: To provide students basic knowledge of the living world, binomial nomenclature, morphology of flowering plants and plant systematic.

Theory

UNIT I

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics.

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UNIT II

Binomial nomenclature and classification Cell and cell division.

UNIT III

Morphology of flowering plants. Seed and seed germination.

UNIT IV

Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

Practical

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

Suggested Readings:

1. Biswas, S. and Biswas, A. (2017). Master Your Biology – 2nd Vol., McGraw Hill Publications.
2. Brooker, R.J. Widmaier, E.P., Graham, L. and Stiling, P. (201). Biology 4th Edition, McGraw Hill Publications.
3. Miller, K. R. (2010). Prentice Hall Biology, Pearson Education, Incorporated.
4. Verma, V. (2013) Ane's Student Edition. Botany. Ane Books Pvt. Ltd., New Delhi, India.

Paper Code	Course Title	L	T	P	Cr
AGS 118A	Elementary Mathematics	1	0	2	2

Course Objective: This is a basic course which will provide basic knowledge of straight lines, circle, differential calculus, integral calculus and matrices and determinants.

Theory

UNIT I

Straight lines: Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two-point form of equation of line, Intercept form of equation of line, Normal form of equation of line,

UNIT II

General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x_1, y_1) & (x_2, y_2) , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line $y = mx + c$ to the given circle $x^2 + y^2 = a^2$.

UNIT III

Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic

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differentiation (Simple problem based on it), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it).

UNIT IV

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

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

XV NSS/NCC/PHYSICAL EDUCATION & YOGA PRACTICES and HUMAN VALUES AND ETHICS

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

Paper Code	Course Title	L	T	P	Cr
AGS 101	NSS	0	1	4	2

Theory

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

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

- Introduction and basic components of NSS: Orientation
- NSS programmes and activities
- Understanding youth
- Community mobilisation
- Social harmony and national integration
- Volunteerism and shramdan
- Citizenship, constitution and human rights
- Family and society
- Importance and role of youth leadership
- Life competencies
- Youth development programmes
- Health, hygiene and sanitation
- Youth health, lifestyle, HIV AIDS and first aid
- Youth and yoga
- Vocational skill development
- Issues related environment
- Disaster management
- Entrepreneurship development
- Formulation of production oriented project
- Documentation and data reporting
- Resource mobilization
- Additional life skills
- Activities directed by the Central and State Government

Semester I

Course Title: National Service Scheme I

Introduction and basic components of NSS:

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

NSS programmes and activities

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

Understanding youth

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

Community mobilization

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

Social harmony and national integration

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

Volunteerism and shramdan

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

Citizenship, constitution and human rights

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

Family and society

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

Semester II

Course Title: National Service Scheme II

Importance and role of youth leadership

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

Life competencies

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

Youth development programmes

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

Health, hygiene and sanitation

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

Youth health, lifestyle, HIV AIDS and first aid

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

Youth and yoga

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

Paper Code	Course Title	L	T	P	Cr
PHE110	Physical Education and Yoga Practices	0	0	4	2

Semester I: Physical Education and Yoga Practices

1. Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
2. Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
3. Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game
4. Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
5. Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation
6. Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game
7. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
8. Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
9. Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
10. Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation
11. Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
12. Teaching of some of Asanas – demonstration, practice, correction and practice
13. Teaching of some more of Asanas – demonstration, practice, correction and practice
14. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
15. Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
16. Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
17. Teaching – Meaning, Scope and importance of Physical Education
18. Teaching – Definition, Type of Tournaments
19. Teaching – Physical Fitness and Health Education
20. Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

Semester II: Physical Education and Yoga Practices

1. Teaching of skills of Hockey – demonstration practice of the skills and correction.

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

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

Paper Code	Course Title	L	T	P	Cr
AGS 107A	Human Values and Ethics	1	0	0	1

Theory

UNIT I

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy.

UNIT II

Self-Exploration. Self-Awareness. Self-Satisfaction.

UNIT III

Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives.

UNIT IV

Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

Suggested Readings:

1. Naagrazan, R. S. A Textbook on Professional Ethics and Human Values. New Age International Pvt Ltd. Second edition
2. Kumar, Varinder. 2016. Human values and professional Ethics. 2014. Kalyani Publishers
3. Gaur, R. R., Sangal, R. and Bagaria, G.P. 2011. A Foundation Course in Human Values and Professional Ethics.

ELECTIVE COURSES

Paper Code	Course Title	L	T	P	Cr
AGS 229A	Agri-business Management	1	0	2	2

Course Objectives: To teach students about agri-business, features of agribusiness management, Agri- value chain, business environment, management functions, capital and financial management of agribusiness, marketing, distribution and project management.

Theory

UNIT I

Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries

UNIT II

Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget.

UNIT III

Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance.

UNIT IV

Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behavior analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management definition, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques

Practical

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

Suggested Readings:

1. G. L. Meena, S. S. Burark, D. C. Pant and Rajesh Sharma. 2017. Fundamentals of Agribusiness Management. Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-418-6. First edition.
2. Gittinger, J.P. 1984. Economic Analysis of Agricultural Projects, John Hopkins University Press.
3. Kotler, Philip. 1999. Marketing Management, Prentice Hall of India, New Delhi,
4. L. L. Somani and G. L. Meena. 2017. Agribusiness & Farm Management at a Glance, Vol-2, Basic & Applied Fundamentals, Agrotech Publishing Academy, Udaipur, ISBN: 978-81-8321-429-2. Second edition.
5. Mamoria, C. B., Joshi, R. L. and Mulla, N. I. 2005. Principles and Practices of Marketing in India, Kitab Mahal, Allahabad.
6. Sudha, G.S. 2000. Business Management. RBSA Publishers, Jaipur.
7. Tripathi, P. C. and Reddy, P. N. 2008. Principles of Management. Tata McGraw Hill Education Private Limited, New Delhi.

Paper Code	Course Title	L	T	P	Cr
AGS 229B	Agrochemicals	2	0	2	3

Course Objectives: To introduce students to various agrochemicals, their management for sustainable agriculture, classification of herbicides, fungicides, insecticides, fertilizers, and biopesticides.

Theory

UNIT I

An introduction to agrochemicals, their type and role in agriculture, effect on environment, soil, human and animal health, merits and demerits of their uses in agriculture, management of agrochemicals for sustainable agriculture.

UNIT II

Herbicides-Major classes, properties and important herbicides. Fate of herbicides.
 Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride.
 Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb.

UNIT III

Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use. Introduction and classification of insecticides: inorganic and organic insecticides Organochlorine, Organophosphates, Carbamates, Synthetic pyrethroids Neonicotinoids, Biorationals, Insecticide Act and rules, Insecticides banned, withdrawn and restricted use, Fate of insecticides in soil & plant. IGRs Biopesticides, Reduced risk insecticides, Botanicals, plant and animal systemic insecticides their characteristics and uses.

UNIT IV

Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate. Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing. Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

Practical

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in market. Estimation of nitrogen in Urea. Estimation of water soluble P₂O₅ and citrate soluble P₂O₅ in single super phosphate. Estimation of potassium in Murreite of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

Suggested Readings:

1. Vasantharaj David, B and Ramamurthy V. V. 2016. Elements of Economic Entomology. Np Namuratha Publications, Chennai.
2. Vasantharaj David, B and Aanathakrishnan, T.N. 2006. General and Applied Entomology. Tata McGraw-Hill Publishing House, New Delhi.
3. Das PC. 2018. Manures and Fertilizers. Kalayani Publishers.
4. Gupta, O. P. 2007. Modern weed management. Dr Upadesh Purohit for Agro Bios, Jodhpur.
5. Das, T. K. 2008. Weed Science - Basics and Applications. Jain Brothers, New Delhi.
6. Chaudhary, J.P. 1995. Fertilizers and Manures. Rama Publishing House, Meerut, U.P.

Paper Code	Course Title	L	T	P	Cr
AGS 229C	Commercial Plant Breeding	1	0	4	3

Course Objectives: To teach students about mode of reproduction, development and maintenance of lines and hybrids in self- and cross-pollinated crops, advances in hybrid seed production in field crops and vegetable crops, innovative strategies for variety development, IPR issues in commercial plant breeding.

Theory

UNIT I

Types of crops and modes of plant reproduction. Line development and maintenance breeding in self- and cross-pollinated crops (A/B/R and two-line system) for development of hybrids and seed production.

UNIT II

Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, castor, sunflower, cotton pigeon pea, Brassica etc. Quality seed production of vegetable crops under open and protected environment.

UNIT III

Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act.

UNIT IV

Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self- and cross-pollinated crops.

Practical

Floral biology in self- and cross-pollinated species, selfing and crossing techniques. Techniques of seed production in self- and cross-pollinated crops using A/B/R and two-line system. Understanding the difficulties in hybrid seed production, Tools and techniques for optimizing hybrid seed production. Concept of rouging in seed production plot. Concept of line, its multiplication and purification in hybrid seed production. Role of pollinators in hybrid seed production. Hybrid seed production techniques in sorghum, pearl millet, maize, rice, rapeseed-mustard, sunflower, castor, pigeon pea, cotton and vegetable crops. Sampling and analytical procedures for purity testing and detection of spurious seed. Seed drying and storage structure in quality seed management. Screening techniques during seed processing viz., grading and packaging. Visit to public private seed production and processing plants.

Suggested Readings:

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

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9. Khare Dharendra and Mohan S. Bhale. 2000. Seed Technology. Scientific Publishers India), Jodhpur.
10. Maloo, S.R., Intodia, S.K. and Pratap Singh. 2008. Beej Pradyogiki. Agrotech Publishing Academy.

Paper Code	Course Title	L	T	P	Cr
AGS 229D	Landscaping	2	0	2	3

Course Objectives: To provide knowledge to students about importance, scope and principles of landscaping, selection, propagation and planting schemes of trees, shrubs, herbaceous perennials, annuals and pot plants, bio- aesthetic planning, landscaping of public places, bonsai management and lawns establishment.

Theory

UNIT I

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

UNIT II

Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting.

UNIT III

Annuals: selection, propagation, planting scheme, other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping.

UNIT IV

Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

Practical

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

Suggested Readings:

1. Bose, T.K., Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping. Naya Prokash.
2. Chadha, K.L. & Chaudhury, B. 1992. Ornamental Horticulture in India. ICAR.

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3. Chadha, K.L. 1995. Advances in Horticulture. Vol. XII. Malhotra Publ. House.
4. Randhawa, G.S. & Mukhopadhyay, A. 1986. Floriculture in India. Allied Publ.
5. Reddy, S., Janakiram, B., Balaji, T., Kulkarni, S. & Misra, R.L. 2007. Hightech Floriculture. Indian Society of Ornamental Horticulture, New Delhi.
6. Nambisan, K.M.P. 1992. Design Elements of Landscape Gardening. Oxford & IBH.

Paper Code	Course Title	L	T	P	Cr
AGS 310A	Food Safety and Standards	2	0	2	3

Course Objectives: To acquaint students with food safety, hazards and risks in food safety, food storage, establishments, food safety measures, food safety management tools, accreditation and auditing, packaging, Indian and International Standards for food products.

Theory

UNIT I

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service

UNIT II

Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis.

UNIT III

Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards- Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens.

UNIT IV

Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenic. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

Water quality analysis physico-chemical and microbiological. Preparation of different types of media. Microbiological Examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

Suggested Readings:

1. Jain, Akalank Kumar and Jain Vidhi. 2015. Food Safety and Standards Act, (Rules & Regulations) Akalank Publications

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Paper Code	Course Title	L	T	P	Cr
AGS 310B	Biopesticides & Biofertilizers	2	0	2	3

Course Objectives: To teach students about biopesticides, classification, mass production technology, applications methods, limitation and uses of biopesticides, biofertilizers, features of bacterial and cyanobacterial biofertilizers and their production technology.

Theory

UNIT I

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationals. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.

UNIT II

Methods of application of biopesticides. Methods of quality control and techniques of biopesticides. Impediments and limitation in production and use of biopesticide.

UNIT III

Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cyanobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.

UNIT IV

Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers - Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

Practical

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

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

Suggested Readings:

1. Purohit, S.S. and Singh, T. 2108. Biofertilizers Technology. Agrobios (India).
2. Srivastava, K. P. and Dhaliwal, G.S. 2015. Applied Entomology. Vol I & II, Kalyani Publishers, New Delhi.

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3. Kannaiyan, S. K. Kumar and K. Govindarajan (eds.) 2004. Biofertilizers Technology. Scientific Pub., Jodhpur.
4. Motsora, M.R., P. Bhattacharya and Beena Srivastava. 1995. Biofertilizer Technology.
5. Subbarao, N.S., 1993. Biofertilizers in Agriculture and Forestry. Oxford and IBH Pub. Co., New Delhi.

Paper Code	Course Title	L	T	P	Cr
AGS 310C	Protected Cultivation	2	0	2	3

Course Objectives: To teach students about protected cultivation, soil preparation and management in protected structures, green house cultivation of horticultural, medicinal and aromatic crops, off - season production and insect pest and disease management in protected structures.

Theory

UNIT I

Protected cultivation- importance and scope. Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation.

UNIT II

Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops.

UNIT III

Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, liliium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, papaya etc.

UNIT IV

Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management. Seed production of vegetable crops under protected structures.

Practical

Raising of seedlings and saplings under protected conditions, use of protrays in quality planting material production, bed preparation and planting of crop for production, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging ad misting.

Suggested Readings:

1. Joe, J. Hanan. 1998. Green houses: Advanced Technology for Protected Horticulture, CRC Press, LLC. Florida.
2. Paul, V. Nelson. 1991. Green house operation and management. Ball publishing, USA.

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3. Lyn. Malone, Anita M. Palmer, Christine L. V. Ioghat Jach Dangeermond. 2002. Mapping out world: GIS lessons for Education. ESRI press.
4. Reed David. 1996. Water, media and nutrition for green house crops. Ball publishing USA.
5. Adams, C.R., K.M. Bandford and M.P. Early. 1996. Principles of Horticulture. CBS publishers and distributors. Darya Ganj, New Delhi.
6. Singh Balraj. 2006. Protected Cultivation of Vegetable Crops. Kayani Publishers.

Paper Code	Course Title	L	T	P	Cr
AGS 310D	Micro propagation Technologies	2	0	2	3

Course Objectives: To teach students about history and basic concepts of plant tissue culture, tissue culture laboratory, micropropagation, cell suspension cultures and production of secondary metabolites and cryopreservation

Theory

UNIT I

Introduction, history and advantages and plant tissue culture. Organization of plant tissue culture laboratory, culture media and PGRs used in plant tissue culture.

UNIT II

Basic concepts of plant tissue culture. Various types of cultures (cell, callus, organ, embryo and seed). Somaclonal variations

UNIT III

Micropropagation, Stages of micropropagation. Axillary bud proliferation, organogenesis, somatic embryo, somatic embryogenesis

UNIT IV

Cell suspension cultures, production of secondary metabolites and cryopreservation

Practical: Various equipments used in plant tissue culture laboratory, Media composition, preparation of MS media, sterilization techniques, Explant preparation, Culturing of explant, shoot proliferation, callus induction, rooting and hardening.

Suggested readings:

1. Mascarenhas, A. F. 2008. Hand book of plant tissue culture. ICAR, New Delhi.
2. Singh, B.D. 2005. Biotechnology, Expanding Horizons. Kalyani Publishers, New Delhi.
3. Razdan, M.K. 2003. Introduction to Plant Tissue Culture. Scientific publishers, India.
4. Gupta, P.K. 2008. Elements of Biotechnology, Rastogi Publications, India.

Paper Code	Course Title	L	T	P	Cr
AGS 330A	Hi-tech. Horticulture	2	0	2	3

Course Objectives:

To enlighten the students with technological and advanced cultivation practices for horticultural crops developed in India as well as those adopted globally for quality production.

Theory

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UNIT I

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods.

UNIT II

Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH-based fertilizer scheduling.

UNIT III

Canopy management, high density orcharding, Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS).

UNIT IV

Variable Rate applicator (VRA), Application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

Practical

Types of polyhouses and shade net houses, Intercultural operations, tools and equipments identification and application, Micro propagation, Nursery-protrays, micro-irrigation, EC, pH-based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

Suggested Readings:

1. Prasad, S., Dharm Singh and Bharadwaj, R. L. 2011. Hi tech Horticulture. Agro Bios.
2. Singh Devendra Kumar. 2004. Hi Tech Horticulture. Agrotech Publishing Academy.
3. Singh, Gorakh. 2010. Canopy Management in Fruit Crops. Department of Agriculture and Co-operation.
4. Srivastava, K.K. 2007 Canopy Management of Fruit crops. International Book Distribution Company.
5. Singh, Jitendra, Jain, S.K., Dashora, L. K. and Chundawat, B. S. 2013. Precision Farming in Horticulture. New India Publishing Agency.

Paper Code	Course Title	L	T	P	Cr
AGS 330B	Weed Management	2	0	2	3

Course Objectives: To introduce students to different weeds, harmful and beneficial effects of weeds, herbicides and weed management using herbicides, application of bio-herbicides in agriculture, management of herbicide resistance.

Theory

UNIT I

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Methods of weed management.

UNIT II

Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management.

UNIT III

Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application.

UNIT IV

Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

Practical

Techniques of weed preservation. Weed identification and their losses study. Biology of important weeds. Study of herbicide formulations and mixture of herbicide. Herbicide and agro-chemicals study. Shift of weed flora study in long term experiments. Study of methods of herbicide application, spraying equipments. Calculations of herbicide doses and weed control efficiency and weed index.

Suggested Readings:

1. Saraswat, V.N., Bhan, V.M. and Yaduraju, N.T. 2003. Weed Management, ICAR, New-Delhi.
2. Gupta, O.P. 2015. Weed Management: Principles and Practices (2nd Ed.), Agribios (India), Jodhpur.
3. Gupta, O.P. 2016. Modern Weed Management, Agribios (India), Jodhpur.
4. Das, T.K. 2008. Weed Science: Basics and Applications, Jain Brothers, New-Delhi.
5. Rao, V.S. 2000. Principle of Weed Science (2nd edition), Oxford and IBH Publishing Co., New Delhi.

Paper Code	Course Title	L	T	P	Cr
AGS 330C	System Simulation and Agro-advisory	1	0	2	2

Course Objectives: To teach students about crop models, elementary crop growth models, crop production in moisture and nutrient deficit conditions, weather forecasting, crop-weather calendars, use of crop simulation models in agro- advisory.

Theory

UNIT I

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams. Evaluation of crop responses to weather elements;

UNIT II

Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modelling techniques for their estimation.

UNIT III

Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity;

UNIT IV

Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

Practical

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential & achievable production; yield forecasting, insect & disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agro-advisory.

Suggested Readings:

1. Reddy, T. Yellamanda and Reddy, G.H. Sankara. 2016. Principles of Agronomy (2nd edition), Kalyani Publishers, Ludhiana
2. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy, Agrobios (India), Jodhpur

Paper Code	Course Title	L	T	P	Cr
AGS 330D	Agricultural Journalism	2	1	2	3

Course Objectives: to acquaint students with comprehensive knowledge of agricultural journalism, newspapers and magazines as communication media, writing agricultural stories.

Theory

UNIT I

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

UNIT II

Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines.

UNIT III

The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.

UNIT IV

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Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

Practical

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

Suggested Readings:

1. Ray, G. L. and Mondal, S. 2005. Journalism including communication, Farm and Rural Journalism, Public Relations, Kalyani Publication, Ludhiana.
2. Bhaskaran et. al. 2008. Farm Journalism and media management. Agrotech Publishing Company.
3. Bhatnagar, R. 2001. Print Media and Broadcast Journalism. Indian Publisher Distributors, Delhi.
4. Katyal, V.P. 2007. Fundamentals of Media Ethics. Cyber Tech Publishers, New Delhi.
5. Subin Mohan et al. 2010. Handbook on farm Journalism. Pulari Publishers, Karnal.
6. Singh, A.K. 2014. Agricultural Extension and Farm Journalism. Agrobios, Jodhpur.

Modules for Skill Development and Entrepreneurship

Paper Code	Course Title	L	T	P	Cr
AGS 411A	Production Technology for Bioagents and Biofertilizer	0	1	20	10

UNIT I

Isolation and pure culture establishment of biofertilizers and bio-pesticides, Sterilization methods, Microscopy, Equipment, machinery and tools used for biopesticide and bioagents. Bioefficacy of different biocontrol agents against pathogens and pests, Mass production of *Trichogramma*, *Cryptolaemus*, *Crysopepla*. Mass multiplication of *Trichoderma/Pseudomonas/Bacillus*. Testing of quality parameters and standardization of biopesticides. Commercialization of biocontrol agents. Screening and bioefficacy of different botanicals against plant pathogens.

UNIT II

Preparation of media used for isolation and culturing of biofertilizers : Jensen's agar, NFb medium, Yeast extract manitol agar, BGA-medium, Pikovaskaya's medium ; Isolation of Rhizobium from root nodules, Isolation of *Azotobacter* from rhizosphere of cereal crops, *Beijernickia*, *Acetobacter* from soil, *Azospirillum* from roots of graminicious plants, BGA from soil, Mycorrhizae from the roots, PSM sulphur oxidizing microorganisms, ion chealator, potash mobilizers ,organic matter decomposers and their isolation in pure culture form.

UNIT III

Methods of application of *Trichoderma/ Pseudomonas/Bacillus/*, *Trichogramma*, *Cryptolaemus*, *Crysopepla*, *Rhizobium*, *Azotobacter*, *Azospirillum* and phosphate solubilizing biofertilizers. Methods of application of *Azolla* and blue green algal biofertilizers in paddy farming.

UNIT IV

Quality control of biofertilizers-standards specified and estimating the viable bacterial count in carrier based biofertilizers. Storage of biofertilizer packets. Visit to biofertilizer plants. Testing the final product in small scale level. Cost analysis of bio-fertilizers and biopesticides.

Suggested readings:

1. Campbell, R. 1989. Biological Control of Microbial Plant Pathogens. Cambridge Univ. Press, Cambridge.
2. Cook, R.J. & Baker, K.F. 1983. Nature and Practice of Biological Control of Plant Pathogens. APS, St. Paul, Mennisota.
3. Fokkemma, M.J. 1986. Microbiology of the Phyllosphere. Cambridge Univ. Press, Cambridge.
4. Gnanamanickam, S.S. (Eds). 2002. Biological Control of Crop Diseases. CRC Press, Florida.
5. Heikki, M.T. & Hokkanen, James M. (Eds.). 1996. Biological Control-Benefits and Risks. Cambridge Univ. Press, Cambridge.
6. Mukerji, K.G., Tewari, J.P., Arora, D.K. & Saxena, G. 1992. Recent Developments in Biocontrol of Plant Diseases. Aditya Books, New Delhi.

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Paper Code	Course Title	L	T	P	Cr
AGS 411B	Seed Production and Technology	0	1	20	10

Course Objectives: To make student aware about growing seed industry, hands on training on production of good quality seeds of different crops, harvesting and processing of different seeds, different seed treatments to improve germination, seed quality control tests, packaging and storage of seed

Practical

UNIT I

Introduction, structure of Seed Industry in India; producing good quality seeds; factors influencing seed production; maintenance of pure accessions; post-harvest processing & certification.

UNIT II

Seed production: Cereals, pulses, vegetable crops (Choice of land, land requirement, isolation, crop field management, rouging, harvesting, threshing, drying, cleaning, treatment, packaging and storage, quality control tests, field standard and seed standards).

UNIT III

Seed certification: Classes of seeds, application for seed production, registration of sowing report, field inspection, field count, harvesting, principles of seed conditioning/processing: sorting, shelling/threshing, drying, cleaning and grading.

UNIT IV

Seed sampling, Seed quality control tests: Seed viability, purity, vigour and seed health, Seed treatments to improve germination: Seed protectants, germination enhancement, inoculation with microorganisms, coatings to help mechanical sowing; packaging & storage, machines used in seed processing.

Suggested Readings:

1. Parimala, K., Subramanian K. S. Mahalinga Kannan and K. Vijayalakshmi. 2013. A Manual on Seed Production and Certification. PM Digital Products, 'Konar Maligai', 25, Peters Road, Chennai - 600 014.
2. Abarna, R Thooyavathy, Sridhar, Subhashini, Subramanian, K. and Vijayalakshmi, K. 2013. Seed Production Techniques for Oilseeds and Pulses. PM Digital Products, 'Konar Maligai', 25, Peters Road, Chennai - 600 014.
3. Lambert, Delimini. 2012. Seed Production and Training Manual. FAO
4. Sen, Subir and Ghosh, Nabinanda. 2015. Seed Science and Technology. Kalyani Publishers. New Delhi.
5. Pooran, M. Gaur, Shailesh, Tripathi, C.L. Laxmipathi, Gowda, G.V. Ranga Rao, H.C. Sharma, Suresh Pande and Mamta Sharma. 2010. Chickpea seed production manual. ICRISAT, Patancheru 502 324 Andhra Pradesh, India

Paper Code	Course Title	L	T	P	Cr
AGS 411C	Mushroom Cultivation Technology	0	1	20	10

UNIT I

Construction cultivation room/structure and Disinfection.

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UNIT II

Compost preparation & pasteurization. Procurement of mother culture and spawn preparation.

UNIT III

Procurement of casing soil and preparation for production. Mushroom seeding, Casing with soil and maintenance

UNIT IV

Harvesting, processing, Grading, packing, marketing and Cost economics of mushroom culture.

Suggested readings:

1. Suman, B. C. and Sharma, V. P. 2007. Mushroom Cultivation in India. Daya Publishing House, New Delhi.
2. Pandey R.K. and Ghosh S. K. 1999. A Handbook of Mushroom Cultivation. Emkay Publications, New Delhi.

Paper Code	Course Title	L	T	P	Cr
AGS 411D	Commercial Beekeeping	0	1	20	10

UNIT I

Apiculture-Scope and importance of beekeeping–Bee classification– Hives –Social organization–extraction and processing of honey and other products. Procurement and arrangement of bee keeping equipments. Location and collection of potent nectar yielding bee flora seeds from wild. Raising/ enriching the high nectar yielding bee flora in the campus.

UNIT II

Location and hiving the natural bee colony from the wild. Establishing the apiary with suitable/favourable necessities. Maintenance and multiplication of hived colonies. Visit to research and training institutions devoted to beekeeping.

UNIT III

Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Management of natural enemies and diseases of bees.

UNIT IV

Maintenance of bee colonies during dearth and honey flow seasons. Harvesting and Processing of honey and bee wax. Marketing of honey and bee wax and value addition. Cost benefits analysis

Suggested readings:

1. Singh, S. (1971) Beekeeping in India, ICAR publication.
2. Mishra R.C. (1995) Honey bees and their management in India. ICAR Publication, New Delhi.
3. Abrol, D.P. 2013. Beekeeping: A Comprehensive Guide to Bee and Beekeeping. Scientific Publishers, Jodhpur.
4. Singh, D and Singh, D.P. 2006. A hand book of Beekeeping. Agrobios, India.
5. Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur.
6. Sunita, N.D, Guled , M.B, Mulla S.R and Jagginavar,2003, Beekeeping, UAS Dharwad.

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Paper Code	Course Title	L	T	P	Cr
AGS411E	Agriculture Waste Management	0	1	20	10

UNIT I

Introduction to agricultural waste management, nature and characteristics of agricultural waste and their impact on the environment, kinds of wastes, classification, role of soil and plants in waste management, sources of waste, impact of waste on soil and plant quality, biological processes of waste management, utilization and recycling of agricultural waste, potential of recyclable crop residues and its management, *in-situ* management of agriculture waste.

UNIT II

Composting: Definition- solid waste suitable for composting, methods of composting, vermicomposting, mineralization process in composting, biochemistry of composting, factors involved, infrastructure required, maturity parameters, value addition and application methods.

UNIT III

Biomass Briquetting: Definition, potential agro residues and their characteristics for briquetting, fundamental aspects and technologies involved in briquetting, economic analysis of briquetting, setting up of briquetting plant and appliances for biomass briquettes.

UNIT IV

Biogas and Bio-ethanol Production: Screening of suitable ligno cellulosic substrate for biogas production, determination of bio-energy potential of agro-waste by estimating total solids, preparation of feed stocks for anaerobic bio- digestion, types of digesters, factors affecting, nutrient value and utilization of biogas slurry, ethanol production from ligno cellulosic wastes, processing of biomass to ethanol. Collection and preparation agricultural waste sample. Determination of pH, EC, CEC, heavy metals, BOD, COD, TSS, TDS, NH₄, Total P, and dissolved reactive P. Nutrient status (N, P, K, secondary and micronutrients) analysis of agricultural waste. Waste management equipment operation, Maintenance and safety hazards, computer software and models. Survey of different agri waste from live stock, dairy, poultry, food processing, fruit & vegetable and agri-chemicals.

Paper Code	Course Title	L	T	P	Cr
AGS411F	Floriculture and Landscaping	0	1	20	10

UNIT I

Planning and layout of commercial garden. Production and management of commercial flowers. Harvesting and postharvest handling of produce. Marketing of produce, Cost Analysis, Visit to Flower growing areas and Export House.

UNIT II

Planning and designing, site analysis, selection and use of plant material for landscaping. Formal and informal garden, features, styles, principles and elements of landscaping.

UNIT III

Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues. Making of lawns.

UNIT IV

Making of bouquets, button hole, wreath, veni and gazaras. Dry flower Technology (identification of suitable species, drying, packaging and forwarding techniques).

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Suggested Readings:

1. Arora, J.S. 2010. Introductory ornamental horticulture. Kalyani Publishers.
2. Swarup Vishnu. 1997. Ornamental horticulture. MacMillan India Ltd.
3. Raj Desh. 2011. Floriculture at Glance. Kalyani Publishers.

Paper Code	Course Title	L	T	P	Cr
AGS411G	Commercial Horticulture	0	1	20	10

UNIT I

Nursery production of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants, plant certification, packaging and marketing, quality control.

UNIT II

Nursery production of ornamentals and vegetables: Production of plantlets, production of potted plants, management and maintenance, sale and marketing.

UNIT III

Protected cultivation of vegetables and flowers: Procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing.

UNIT IV

Role of plastic mulch in polyhouse, drip irrigation and fertigation, staking and training, vegetable grafting, plant protection under protected environment.

Suggested Readings:

1. Dhaliwal M.S. 2008. Handbook of vegetable crops, Kalyani Publishers, Ludhiana.
2. Anonymous. 2018. Package of Practices for Vegetable crops, P.A.U. Publications Ludhiana.
3. Purthy, J.S. 1996. Spices and Condiments. National Book Trust. 322p.
4. Bhattacharjee, Supriya. 2007. Ornamental crop production technology. Pointer Publishers. Jaipur.
5. Randhawa, Gurcharan Singh and Mukhopadhyaya, Amitabha. 2001. Floriculture in India. Allied Publishers. 660p.
6. Adams, C.R. and Early, M. P. 2004. Principles of horticulture. Butterworth – Heinemann, Oxford University Press.
7. Chadha, K.L. 2001, Handbook of Horticulture, ICAR, New Delhi.
8. Bose, T.K. and Mitra, S. K. 2001. Fruits: Tropical and Subtropical. Naya Prokash; 3rd revised edition.
9. Anonymous. 2018. Package of Practices for Fruit Crops, P.A.U. Publications Ludhiana.
10. Bal J. S. 2007. Fruit Growing. Kalyani Publishers.

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Paper Code	Course Title	L	T	P	Cr
AGS411I	Food processing	0	1	20	10

UNIT I

Equipment used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables.

UNIT II

Preparation of nectar, squash, cordial, syrup, jam, jelly and marmalade.

UNIT III

Preparation of candies, preserves, chutneys, sauces, pickles (hot and sweet).

UNIT IV

Dehydration of fruits and vegetables, refrigeration and freezing, cut out analysis of processed foods.

Suggested Reading:

1. Girdhari Lal, G.S. Siddappa and G.L. Tandon. 1959. Preservation of Fruits and Vegetables. ICAR, New Delhi.
2. James G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH & Co., Weinheim, Germany.
3. P. Fellows. 2000. Food Processing Technology: Principles and Practice. 2nd Ed. CRC Press, Boca Raton, FL, USA.
4. Dauthy and Mircea, E. 1995. Fruit and vegetables processing. International Book Distribution Co, Lucknow.

Paper Code	Course Title	L	T	P	Cr
AGS411J	Organic Production Technology	0	1	20	10

UNIT I

Organic farming: Definition, importance and scope, potential of organic farming and its difficulties. Concept of different cropping systems in relation to organic farming. Biological intensive nutrient management-organic manures such as FYM/Rural compost, city compost, oil cakes, animal wastes, vermicomposting, green manuring etc., recycling of organic residues, bio fertilizers; soil improvement and amendments.

UNIT II

Integrated diseases and pest management – use of biocontrol agents, bio pesticides pheromones, trap crops, bird perches; weed management; quality considerations, certification, labeling and accreditation processors, marketing, exports.

UNIT III

Preparation of quality compost material, study of earthworm and methods of vermicomposting. Production and use of BGA and azolla, use of Rhizobium, Azotobacter and Azospirillum, Phosphate solubilizing bacteria, mycorrhiza.

UNIT IV

Vegetable and medicinal crops nursery raising. Raising of vegetable crops organically macro quality analysis, grading, packaging, post-harvest management.

Paper Code	Course Title	L	T	P	Cr
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AGS411K	Commercial Sericulture	0	1	20	10
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UNIT I

Sericulture and its importance, requirements in sericulture, establishment of mulberry garden. Mulberry cultivation, mulberry varieties. Preparation of mulberry cuttings, planting methods. Maintenance of mulberry garden-pruning, manure and fertilizer application, irrigation and methods of harvesting and preservation of leaves. Mulberry pests and diseases, nutritional disorders their management and. Herbarium preparation for host plants and weeds.

UNIT II

Maintaining cultivation sheet and recording observations on seasonal growth and development of mulberry. Pruning practices, fertilizer management, irrigation, dry farming practices and leaf yield of mulberry. Economics of leaf production per unit area of mulberry. Mulberry pests and diseases and their management and nutritional disorders.

UNIT III

Study of different species, their systematic position and salient features. Rearing techniques of mulberry, muga, eri, tassar and mulberry silkworm. Nutritional requirements of silkworms. Sericulture equipments for silkworm rearing houses and appliances. Disinfection. Incubation. Brushing. Leaf preservation. Chawki and late age rearing. Bed cleaning and Spacing. Silkworm breeds, types of voltinism and biology of silkworm. Seed Production and Its economics. Morphology, silk glands. Components of Sericulture. Changes during moulting and ripening. Changes in pupal morphology with age. Rearing, mounting and harvesting of cocoons. Care and Post-harvest processing of Cocoons. Production and Marketing. Components of Sericulture. Changes during moulting and ripening. Changes in pupal morphology with age. Rearing, mounting and harvesting of cocoons. Seed Production and Its economics. Rearing of silkworms-chalky rearing. Rearing of silkworms late age silkworm rearing and study of mountages. Methods of disinfection. Care and Post-harvest processing of Cocoons. Production and Marketing.

UNIT IV

Study of different diseases, insect and non-insect pests and their management. Uji fly life cycle, identification of pest damaged worms and cocoons, case studies. National and International Silk Organizations, Organizational set up in different countries including India. Development of sericulture through plans. Visit to different silkworm rearing areas.

Suggested Readings:

1. Y. A. Shinde and B.R. Patel. Sericulture in India
2. Rangaswamy, G., Narsimhanna, M.N., Kasiviswanathan, K., Sastry, C.R. and Manjeet, S. Jolly, 1976. *Sericulture manual, mulberry cultivation*, vol.1, F FAO Agriculture Services Bulletin. Rome. P. 150.
3. Tribhuwan Singh. Principles and Techniques of Silkworm Seed Production. Discovery publishing House Pvt. Ltd
4. M. L. Narasaiah. Problems and Prospects of Sericulture. Discovery publishing House Pvt. Ltd.
5. Ganga, G. and Sulochana Chetty, J. 1997. An introduction to Sericulture (2nd Edn.). Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.
6. Krishnaswamy, S. (Ed). 1978. Sericulture Manual - Silkworm Rearing. FAO Agrl. Services bulletin, Rome.
7. Jolly, M.S. 1987. Appropriate sericulture techniques. International centre for training and Research in Tropical Sericulture, Mysore,

Paper Code	Course Title	L	T	P	Cr
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AGS411L	Soil, Plant, Water and Seed Testing	0	1	20	10
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UNIT I

Introduction of analytical instruments, calibration & applications, Colorimetry and flame photometry. Soil sampling, Critical levels of different nutrients in soil. Estimation of soil pH, soil electrical conductivity. Estimation of soil organic carbon, alkaline hydrolysable Nitrogen in soils. Estimation of soil extractable Phosphorus, exchangeable Potassium in soils, exchangeable Calcium and Magnesium in soils, estimation of soil extractable Sulphur in soil. Estimation of DTPA extractable Zn in soils.

UNIT II

Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Estimation of Nitrogen in plants. Estimation of Phosphorus in plants. Estimation of Potassium in plants. Estimation of Sulphur in plants.

UNIT III

Determination of electrical conductivity of irrigation water. Determination of carbonate bicarbonate and chloride in irrigation water. Quality of irrigation water. Determination of calcium and magnesium in irrigation water by Versenate Method. Determination of Sulphate in irrigation water by turbidimetric method.

UNIT IV

Procurement of seed material of various crops. Seed sampling principles and procedures. Testing physical seed purity and health. Analysis of moisture content, viability and germination of various sampled seed. Study the effect of reduced and increased seed moisture content on seed germination, viability and vigor. Assessment of genetic purity by conducting a Grow Out test. Specialized lecture by Seed Certification Officer. Visit to a Seed Testing Laboratory.

Suggested Readings:

1. Tisdale, S.L. Nelson, W.L. Beaton, J.D. and Havlin, J.L. 1991. Soil fertility and fertilizers. Prentice Hall of India, Pvt. Ltd, New Delhi.
2. Mehra R.K. 2004. Text book of Soil Science, ICAR New Delhi.
3. Yawalkar, K.S. and Agarwal. J.P. 1992. Manure and fertilizers. Agriculture – Horticulture Publishing House, Nagpur.
4. Biswas, T.D. and Mukherjee, S.K. 2006. Text book of soil science. Tata Mc Graw Hill publishing Co. Ltd, New Delhi.
5. Brady, N.C. and Weil, R.R. 2002. The nature and properties of soils, prentice hall of India Pvt. Ltd, M-97, Connaught Circus, New Delhi.