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

2023–2024 session onwards

Applicable for admissions in 2023

Faculty of Agricultural Sciences

Vision

Develop human resource to be able to cater to the needs of stakeholders in academia, industry and public/private sector for achieving livelihood security through sustainable agriculture.

Mission

M1: Developing excellence in agriculture education and emerging as leader

M2: Imparting education to foster inter- disciplinary approach for sustainable agriculture

M3: Training manpower for upcoming challenges in agriculture with an aim at resource conservation and enhancing farm income

The B.Sc. (Hons.) Agriculture program is a comprehensive undergraduate degree designed to provide students with in-depth knowledge and skills related to agricultural sciences. It typically covers a wide range of subjects including plant and soil sciences, agronomy, horticulture, plant breeding, agricultural economics, pest management, and sustainable farming practices. Students also learn about farm management, animal husbandry, and modern agricultural technologies.
The program is designed to prepare graduates for careers in farming, agricultural research, extension services, and the agricultural industry. It combines theoretical learning with practical hands-on experience, often through fieldwork and internships. This degree aims to produce skilled professionals capable of addressing global food security and environmental challenges.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

PEO1: To encourage students to be creative and innovative to meet the needs of agro based industry by providing a dynamic learning environment

PEO2: To develop competent human resource in teaching and research in crop production, crop improvement, plant protection and marketing to meet national and global challenges

PEO3: Developing entrepreneurial skills in students to be 'Job providers rather than Job seekers'

PEO4: To develop skills of ethical integrity and professional engagement among students to be the voice of farmers and represent them in various national and international forums

PROGRAMME SPECIFIC OUTCOMES (PSO's)

PSO1: Enable students to develop skills to be the leaders of agro industry.

PSO2: To be conversant with the latest state of the art innovations in agricultural sciences.

PSO3: Students acquire skills in subsidiary agriculture occupations like dairy, bee keeping, mushroom cultivation and organic farming etc.

PSO4: In-depth knowledge of agriculture and skills to solve the problems of farming community enable students to be a good policy makers by framing policies for the upliftment of farmers.

PROGRAMME OUTCOMES (POs)

After the successful completion of undergraduate course, Agriculture graduates will be able to:

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Discipline-wise summary of credit hours

S.N.	Group	Credits
1.	Agronomy	21(10+11)
2.	Genetics & Plant Breeding	13(7+6)
3.	Soil Science & Agricultural Chemistry	8(6+2)
4.	Entomology	9(6+3)
5.	Agricultural Economics	10(7+3)
6.	Agricultural Engineering	8(4+4)
7.	Plant Pathology	13(9+4)
8.	Horticulture	10(5+5)
9.	Food Science	2(2+0)
10.	Agricultural Extension	9(6+3)
11.	Biochemistry / Physiology / Microbiology/ Environmental Sciences	12(7+5)
12.	Statistics, Computer Application and I.P.R.	5(3+2)
13.	Animal Production	4(3+1)
14.	English	2 (1+1)
15.	Remedial Courses	02 (Biol/ Math); 04 (Agriculture)
16.	NSS/NCC/Physical Education & Yoga Practices	4(0+2)
17.	Human Values and Ethics	1(1+0)
18.	Elective courses	9 (2+1)
Total		134 + 2 (for Bio / Math) + 9 credits elective courses
READY component- I (RAWE +IA) **READY component- II (ELP modules)**		20 20
Grand Total		145+20+20=185

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
11.		NSS/NCC/Physical Education and Yoga Practices	0	0	4	2
						23

**- 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.	AGS 107B	Human Values & Ethics	1	0	0	1
11.		NSS/NCC/Physical Education and Yoga Practices	0	0	4	2
						24

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

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 *(Kharif Crops)*	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.		NSS/NCC/Physical Education & Yoga Practices	0	1	4	2
						26

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 *(Rabi Crops)*	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	Problematic Soils and their Management	1	0	2	2
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.	AGS 228A	Soil and Water Conservation Engineering	1	0	2	2
9.	EVS 212	Environmental Studies and Disaster Management	2	0	2	3
10.	AGS229 E/F/G/H	Elective Course#	2	0	2	3
11.		NSS/NCC/Physical Education & Yoga Practices	0	1	4	2
						24

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

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	Manures, Fertilizers and Soil Fertility Management	2	0	2	3
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 *(Kharif Crops)*	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 (*Kharif* crops)	0	1	4	2
9.	AGS 319	Intellectual Property Rights	1	0	0	1
10.	AGS310 E/F/G/H	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 *(Rabi crops)*	1	0	2	2
7.	AGS 326	Practical Crop Production –II (*Rabi* crops)	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	1	0	2	2
11.	AGS330 E/F/G/H	Elective Course#	2	0	2	3
						24

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

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

STUDENT READY PROGRAMME –I (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

S. No.	Paper Code	Course Title	L	T	P	Cr
1	AGS 412	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 413	Plant clinic	0	1	4	2
3	AGS 414	Agro-Industrial Attachment	0	1	8	4
						20

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

RAWE (Component-I)
Village Attachment Training Programme

S. No.	Activity	Duration
1	Orientation and Survey of Village	1 week
2	Agronomical Interventions	1 week
3	Plant Protection Interventions	1 week
4	Soil Improvement Interventions (Soil sampling and testing)	1 week
5	Fruit and Vegetable production interventions	1 week
6	Food Processing and Storage interventions	
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 for03 weeks.
- Industries include Seed/Sapling production, Pesticides-insecticides, Post-harvest-processing-value addition, Agri-finance institutions, etc.

Activities and Tasks during Agro-Industrial Attachment Programme

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

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

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.

S. No	Paper Code	Course Title	L	T	P	Cr
1	AGS 424	Commercial Horticulture	0	1	20	10
2	AGS 425	Commercial Apiculture	0	1	20	10
3	AGS 426	Mushroom Cultivation Technology	0	1	20	10
4	AGS 427	Organic Production Technology	0	1	20	10
						20

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

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 229E	Introduction to Protected Cultivation	2	0	1	3
6.	AGS 229F	Introduction to Mushroom Cultivation	2	0	1	3
7.	AGS 229G	Introduction to Beekeeping	2	0	1	3
8.	AGS 229H	Introduction to Non- Conventional Farming	2	0	1	3
9.	AGS 310E	Food Safety and Standards	2	0	2	3
10.	AGS 310F	Biopesticides & Biofertilizers	2	0	2	3
11.	AGS 310G	Protected Cultivation	2	0	2	3
12.	AGS 310H	Micro propagation Technologies	1	0	4	3
13.	AGS 310E	Principles and practices of Protected Cultivation	2	0	1	3
14.	AGS 310F	Principles and practices of Mushroom Cultivation	2	0	1	3
15.	AGS 310G	Principles and practices of Beekeeping	2	0	1	3
16.	AGS 310H	Principles and practices of Non- Conventional Farming	2	0	1	3
17.	AGS 330A	Hi-tech. Horticulture	2	0	2	3
18.	AGS 330B	Weed Management	2	0	2	3
19.	AGS 330C	System Simulation and Agro-advisory	2	0	2	3
20.	AGS 330D	Agricultural Journalism	2	0	2	3
21.	AGS 330E	Commercial Protected Cultivation	1	0	2	3
22.	AGS 330F	Commercial Beekeeping	1	0	2	3
23.	AGS 330C	Commercial Mushroom Cultivation	1	0	2	3
24.	AGS 330H	Commercial Non- Conventional Farming	1	0	2	3

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

Semester I

In Hours			
L	T	P	Credits
3	0	2	3

Course Code	**AGS 111**						
Course Title	**Fundamentals of Agronomy**						
Hours	60 L:3, T:0, P:2						
Credits	4						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Well versed with basic concepts, components and terms of Agronomy. **CO2:** Understand concepts of different cropping systems, nutrient management, water management **CO3:** Learn classification and management of weeds **CO4:** Learn about ideotypes in different crops.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • Introduction of Agronomy and its scope • Role of Agronomist • Seeds and sowing • Tillage and tilth • Crop density and geometry • Crop nutrition						**CO1**
	Unit 2: (8 hours) • 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						**CO2**
	Unit 3: (8 hours) • Weeds- importance, classification						**CO3**

	• Crop weed competition • Concept of weed management- principles and methods • Herbicides- classification • Mode of action of herbicides • Herbicide selectivity and resistance • Allelopathy	
	Unit 4: (12 hours) • 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.	**CO4**
	Practical (24 hrs) • 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.	
Reference Books	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	

In Hours			
L	T	P	Credits

2	0	0	2

Course Code	**AGS 112**						
Course Title	**Fundamentals of Agricultural Economics**						
Hours	24 L: 2 T: 0 P: 0						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: Students will have understanding of agri. Economic terms, concepts and theories, market structure and how money is supplied. **CO2**: Students will also understand limited resources available in economy. **CO3**: They will also realize the need to exploit and utilize development and improvement of production techniques. **CO4:** They will learn about taxes and money						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**		**50%**		**5%**
Examination Mode	Theory						
Syllabus	**Unit 1: (6)** • 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.						**CO1**
	Unit 2: (6) • *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						**CO2**

	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 3: (6) • 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 programmers on population control.	**CO3**
	Unit 4: (6) • 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.	**CO4**
Reference Books	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	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 113**						
Course Title	**Fundamentals of Genetics**						
Hours	48 L2+ P2						
Credits	3						
Course Outcomes	After completing course, students will be learn: **CO1**: Different methods available to study genetics **CO2**: Describe gene structure, chromosome and proteins. **CO3:** They will also be able to describe different methods of gene testing, **CO4**: molecular genetic analysis of genetic diseases, construction of pedigrees and analysis of inheritance pattern in the families.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6)** • 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						**CO1**
	Unit 2: (6) • 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.						**CO2**
	Unit 3: (6) • Study of chromosome structure, morphology, number and types, Karyotype and Idiogram. • Numerical chromosomal aberrations (Polyploidy) and Structural chromosomal aberrations and their role in						**CO3**

	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 4: (6) • 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.	**CO4**
	Practical (24 hrs) • 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 114**						
Course Title	**Communication Skills and Personality Development**						
Hours	36 L:1, P:2						
Credits	2						
Course Outcomes	After successful completion of this course, **CO1**: The soft skill will be inculcated in the students in theoretical as well as practical ways. **CO2:** The communication skills of the students will be enhanced and they will get an understanding of the nonverbal forms of communication. **CO3**: They wil learn about various writing techniques **CO4**: They will learn about reading, listening and note making						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**			**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (2)** • Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication;						**CO1**
	Unit 2: (4) • Listening and note taking • Writing skills • Oral presentation skills • Field diary and lab record • Indexing, footnote and bibliographic procedures.						**CO2**
	Unit 3: (3) • Reading and comprehension of general and technical articles • Precise writing • Summarizing • Abstracting;						**CO3**
	Unit 4: (3) • Individual and group presentations • Impromptu presentation						**CO4**

	• Public speaking • Group discussion • Organizing seminars and conferences.	
	Practical (24 hrs) • 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 115**						
Course Title	**Fundamentals of Soil Science**						
Hours	48 L: 2, P: 2						
Credits	3						
Course Outcomes	**CO1**: It will enable students to understanding the soil, their role and properties. **CO2**: Development of soil profile and soil forming processes. **CO3**: They will also learn the classification, characteristics of different soil. **CO4**: Distribution, soil organic matter, its importance and maintenance of organic matter.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6)** • 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.						**CO1**
	Unit 2: (6) • 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.						**CO2**
	Unit 3: (6) • 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						**CO3**

	exchange capacity, base saturation.	
	Unit 4: (6) • 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.	**CO4**
	Practical (24 hrs) • 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.	
Reference Books	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. 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	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 116A**						
Course Title	**Introductory Agro meteorology & Climate Change**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: Students will be able to know the impact of weather and climate on agricultural production system and. **CO1:** Understanding the meaning and scope of agricultural meteorology **CO2:** Learn about solar radiations **CO3:** Learn about different weather phenomena **CO4:** Learn about climate change, its cause and impact on crop growth and development						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**			**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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						**CO1**
	Unit 2: (3 hours) • 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.						**CO2**
	Unit 3: (3 hours)						**CO3**

	• 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 4: (3 hours) • 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	**CO4**
	Practical (24 hrs) • 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.	
Reference Books	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 Reddy, S.R., 2016. Introduction to Agriculture and Agrometeorology. Kalyani Publishers, Ludhiana.	

In Hours			
L	T	P	Credits
1	0	0	1

Course Code	**AGS 117**						
Course Title	**Agricultural Heritage**						
Hours	15 L:1						
Credits	1						
Course Outcomes	**CO1**: Students will be introduced to Indian agricultural heritage, ancient agricultural practices and relevance with modern agricultural practices. **CO2**: They will know the scope of agriculture and agricultural resources in India, development in agriculture and future vision. **CO3**: Importance of agriculture and agricultural resources available in India **CO4**: Learn about agriculture set up in India						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**		**50%**		**5%**
Examination Mode	Theory						
Syllabus	**Unit 1: (3 hours)** • 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.						**CO1**
	Unit 2: (3 hours) • 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.						**CO2**
	Unit 3: (3 hours) • Agriculture scope • Importance of agriculture and agricultural resources available in India • Crop significance and classifications.						**CO3**
	Unit 4: (3 hours) • National agriculture setup in India • Current scenario of Indian agriculture • Indian agricultural concerns and future prospects.						**CO4**

Reference Books	1. Anonymous. 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- Histroy Foundation, Secunderabad, Andhra Pradesh. 3. Nene, Y.L., Saxena, R.C. and Choudhary, S.L. 2009. A Textbook on Ancient History of Indian Agriculture. Munshiram Manoharial Publishers Pvt. Ltd. 4. Nene, Y.L., Choudhary, S.L. and Saxena, R.C. 2010. Textbook on Ancient History of Indian Agriculture. Asian Agri-History Foundation. 5. D. Kumari, Manimuthu Veeral. 2014. Text Book on Agricultural Heritage of India. Agrotech Publishing Academy.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	AGS 118						
Course Title	**Introductory Biology**						
Hours	36 L:1, P:2						
Credits	2						
Course Outcomes	The students will **CO1**: Learn basics of living world **CO2**: Be able to recognize and apply basic ethical principles in research related to biological and biomedical science. **CO3**: Organic evolution process and other fundamental biological processes. **CO4**: They will also be able to explain importance of biodiversity at the genetic, organismal, community and global scales.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**			**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Introduction to the living world, diversity and characteristics of life, origin of life • Evolution and Eugenics.						**CO1**
	Unit 2: (3 hours) • Binomial nomenclature and classification • Cell and cell division.						**CO2**
	Unit 3: (3 hours) • Morphology of flowing plants. • Seed and seed germination						**CO3**
	Unit 4: (3 hour) • Plant systematic- *viz*; Brassicaceae, Fabaceae and Poaceae. • Role of animals in agriculture						**CO4**
	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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
2	0	0	2

Course Code	**AGS 118A**						
Course Title	**Elementary Mathematics**						
Hours	24 L:2						
Credits	2						
Course Outcomes	The students will be able to **CO1**: Learn basics mathematics applied in agricultural sciences **CO2**: Learn about straight lines, circles and different equations **CO3**: Understand the basics of differential and integral calculus **CO4**: Learn basics of matrices and determinants						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**		**50%**		**5%**
Examination Mode	Theory						
Syllabus	**Unit 1: (6 hours)** • 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,						**CO1**
	Unit 2: (6 hours) • 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						**CO2**

	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 3: (6 hours) • 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 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 onit).	**CO3**
	Unit 4: (6 hours) • 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**.**	**CO4**

In Hours			
L	T	P	Credits
1	0	2	2

Introduction to Forestry

Course Code	**AGS 119**						
Course Title	**Introduction to Forestry**						
Hours	36 L: 1, P: 2						
Credits	2						
Course Outcomes	After the course, students will be able to **CO1**: Learn about forestry, its importance, various terms related to forestry **CO2**: Identify the various forest tree species, **CO3**: Understand the methods of multiplication of forest trees and also factors those affects the growth of trees. **CO4**: They will also know the economic importance of forests.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**			**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (4 hours)** • 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.						**CO1**
	Unit 2: (4 hours) • 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.						**CO2**
	Unit 3: (4 hours) • Instrumental methods of height measurement - geometric and						**CO3**

	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 4: (4 hours) • 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.	**CO4**
	Practical: (20 hours) • 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.	
Reference Books	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.	

Semester 2

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 121**						
Course Title	**Agricultural Microbiology**						
Hours	36 L:1, P:2						
Credits	2						
Course Outcomes	Students will be able to know in detail: **CO1**: About the role of microbes in crop production **CO2**: They will also know about bacterial genetics, biofuel and bio- fertilizers production; and biodegradation of agro waste. **CO3**:Role of microbes in soil fertility **CO4**: Role of microbes in human welfare						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**			**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Introduction to Microbial world: Prokaryotic and eukaryotic microbes. • Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth.						**CO1**
	Unit 2: (3 hours) • Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposons.						**CO2**
	Unit 3: (4 hours) • 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						**CO3**
	Unit 4: (2 hours) • Microbes in human welfare: silage production, mushroom cultivation, *Morchella*, Single cell proteins (SCPs), bio-						**CO4**

	pesticides, antibiotics. • Bio-fuel production and bio-degradation.	
	Practical (24 hours) • Introduction to microbiology laboratory and its equipment; 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.	
Reference Books	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. 3. Nicklin, J., Graeme-Cook, K. and Killington, R. 2011. Instant Notes; Microbiology, 4th Edition, BIOS Publications 4. Salle, A.J. 1974. Fundamentals Principles of bacteriology. Mac Graw Hill, Inc..	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 122**						
Course Title	**Fundamentals of Agricultural Extension Education**						
Hours	48 L: 2, P: 2						
Credits	3						
Course Outcomes	After the course, students **CO1**: Will know the concepts of extension education and importance in agriculture development. **CO2**: Students will be exposed to various rural problems and to alleviate them via rural development programmes. **CO3**: They will also know how to increase employment opportunities and their analysis. **CO4**: Will learn about extension teaching methods						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6)** • 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.						**CO1**
	Unit 2: (6 hours) • 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.						**CO2**

	pluralistic extension.	
	Unit 3: (6 hours) • 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.	**CO3**
	Unit 4: (6 hours) • 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.	**CO4**
	Practical (24 hours) • 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 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.	
Reference Books	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	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 123**						
Course Title	**Fundamentals of Crop Physiology**						
Hours	36 L: 1, P: 2						
Credits	2						
Course Outcomes	Students will learn about **CO1**: Plant cell structure, organization and applying specific biochemical functions to all compartments of the plant cell **CO2**: Different processes like photosynthesis. **CO3**: About the process of respiration **CO4**: Knowledge of plant growth regulators and different cycles will all prove to be beneficial in their career.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**			**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Introduction to crop physiology and its importance in Agriculture • Plant cell: an overview • Diffusion and osmosis, absorption of water, transpiration and stomatal physiology.						**CO1**
	Unit 2: (3 hours) • Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms • Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants.						**CO2**
	Unit 3: (3 hours) • Respiration: Glycolysis, TCA cycle and electron transport chain • Fat Metabolism: Fatty acid synthesis and breakdown.						**CO3**
	Unit 4: (3 hours) • 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.						**CO4**

	Practical (24 hours) • Study of plant cells • Structure and distribution of stomata • Imbibition, 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 CO_2 assimilation by Infra-Red Gas Analyzer (IRGA).	
Reference Books	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.	

In Hours			
L	T	P	Credits
3	0	2	4

Course Code	**AGS 124**						
Course Title	**Fundamentals of Entomology**						
Hours	60 L: 3, P: 2						
Credits	4						
Course Outcomes	After this course, students will be able to **CO1**: Identify the insects morphologically, **CO2**: Learn their characters, feeding habits **CO3**: habitats of agriculturally important insect pests. **CO4**: They will also know about concept of IPM, its practices, scope and limitations.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (10 hours)** • 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, secretary (Endocrine) and reproductive system, in insects. • Types of reproduction in insects. • Major sensory organs like simple and compound eyes chemoreceptor.						**CO1**

	Unit 2: (10) • 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.	**CO2**
	Unit 3: (6 hours) • 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.	**CO3**
	Unit 4: (10 hours) • 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, anti- feedants, hormones, attractants, gamma radiation. • Insecticides Act 1968-Important provisions. • Application techniques of spray fluids. • Symptoms of poisoning, first aid and antidotes.	**CO4**
	Practical (24 hours) • 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.	
Reference Books	1. Mani, M.S. 1973. General Entomology. Oxford & I.B.H. Pub. New Delhi. 2. David, B. V. and Ananthakrishnan, T. N. 2006.Generaland applied Entomology. Second Edition. Tata McGraw Hill, New Delhi 3. Nayar, K.K., Ananthakrishanan, T.N., and David, V.B. 1976. General and applied entomology, Tata Mc Graw-Hill 4. Raghumuthy, 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,	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 125**						
Course Title	**Fundamentals of Horticulture**						
Hours	36 L: 1, P: 2						
Credits	2						
Course Outcomes	After studying this course the students will be enlightened with **CO1**: New areas of horticulture, present and future prospectus of horticulture. **CO2**: Propagation of horticultural crops **CO3**: Types of gardens **CO4**: Importers of growth regulators						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**			**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Horticulture - History of horticulture, Punjab Horticulture, Institutes of Horticulture. • Definition and branches of horticulture, Importance and scope • Horticultural and botanical classification.						**CO1**
	Unit 2: (3 hours) • 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.						**CO2**
	Unit 3: (3 hours) • Kitchen gardening; garden types (Hindu, Japanese, Persian, Moghul, Italian, Mediaeval, French, British) and pots; lawn making.						**CO3**
	Unit 4: (3 hours) • Importance of plant bio-regulators in horticulture. • Irrigation methods • Fertilizer and biofertilizer application in horticultural crops.						**CO4**

	Practical (24 hours) • 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. • Preparation of plant bio regulators and their uses. • Fertilizer application in different crops. Visits to commercial nurseries/orchard.	
Reference Books	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 5. Bal, J. S. 2014. Fruit growing. 3rd edition Kalyani Publishers.	

In Hours			
L	T	P	Credits
2	0	2	3

Fundamentals of Plant Biochemistry and Biotechnology

Course Code	**AGS 126**						
Course Title	**Fundamentals of Plant Biochemistry and Biotechnology**						
Hours	48 L: 2, P: 2						
Credits	3						
Course Outcomes	After course completion, student will be well versed with **CO1**: Concepts and application of plant biotechnology and plant biochemistry. **CO2**:Biochemical analysis skills, knowledge on biotechnological tools, **CO3**: plant tissue culture, enzyme kinetics and their implication in enhancing crop productivity is imported. **CO4**: Being industry ready and skilled in making buffers and solutions also.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • 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.						**CO1**
	Unit 2: (6 hours) • Metabolism: Basic concepts • Glycolysis, • Citric acid Cycle, • Oxidative phosphorylation. • Biosynthesis: Carbohydrates, Lipids, Proteins and Nucleic acids. • Metabolic regulation.						**CO2**
	Unit 3: (6 hours) • Concepts of Plant Biotechnology						**CO3**

	• 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 4: (6 hours) • 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). Genome editing (CRISPR/Cas9), • Importance of bioinformatics.	**CO4**
	Practical (24 hours) • 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 127**						
Course Title	**Fundamentals of Plant Breeding**						
Hours	48 L: 2, P: 2						
Credits	3						
Course Outcomes	After this course, students will have learnt **CO1**: Learn and have basic understanding of different activities in plant breeding, role, achievements and future prospects of plant breeding **CO2**: Learn about different methods used for developing improved varieties in important self- pollinated crops. **CO3**: Learn the techniques used in breeding often cross pollinated, cross pollinated crops and vegetatively propagated crops **CO4**: Students will be versed with innovative breeding techniques in developing improved varieties and role of IPRs in plant breeding						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (5 hours)** • 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.						**CO1**
	Unit 2: (7 hours) • 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.						**CO2**

	Unit 3: (5) • Genetic basis and methods of breeding cross pollinated crops • 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.	**CO3**
	Unit 4: (7 hours) • Wide hybridization and pre-breeding • Polyploidy in relation to plant breeding • Mutation breeding-methods and uses • Breeding for important biotic and abiotic stresses; • Biotechnological tools-DNA markers and marker assisted selection. • Participatory plant breeding, Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights • Speed breeding.	**CO4**
	Practical (24 hours) • 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.	
Reference Books	1. Allard, R.W., 2000. Principles of Plant Breeding. John Willey &	

	Sons, New York. 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, VoI. III. Shiksha Prakashan, S. M. S. Highway, Jaipur.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**CSA257**						
Course Title	**Agri- Informatics**						
Hours	36 L: 1, P: 2						
Credits	2						
Course Outcomes	After completing this course, students will understand **CO1**: Computer basics, MS office basics, internet and www basics. **CO2**: Hardware and software, use of IT applications, and different IT tools in agriculture. **CO3**: Use of decision support system, agri, export system **CO4**: Soil info system in agriculture.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**-**	**-**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Introduction to Computers, Operating Systems, definition and types, • Applications of MS Office for document creation & Editing, • Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, • Database, concepts and types, uses of DBMS in Agriculture,						**CO1**
	Unit 2: (3 hours) • World Wide Web (WWW): Concepts and components. • Introduction to computer programming languages, concepts and standard input/output operations. • e- Agriculture, concepts and applications, Use of ICT in Agriculture. • Computer Models for understanding plant processes.						**CO2**
	Unit 3: (3 hours) • IT application for computation of water and nutrient requirement of crops, • Computer-controlled devices (automated systems) for Agri-input management,						**CO3**

	• Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; • Geospatial technology for generating valuable agri-information.	
	Unit 4: (3 hours) • 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.	**CO4**
	Practical (24 hours) • 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/Crop Syst/ • 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.	
Reference Books	1. Vanitha, G. 2011. Agri informatics. New India Publishing Agency 2. Chakravarthy, R. 2006. Agri Informatics: An Introduction (Industry Series) ICFAI University Press	

In Hours			
L	T	P	Credits
1	0	0	1

Course Code	**AGS 107B**						
Course Title	**Human Values & Ethics**						
Hours	12 L: 1						
Credits	1						
Course Outcomes	After successful completion of course the students will be able to **CO1**: Analyze and identify an ethical issue **CO2**: Assess their own ethical values **CO3**: Identify ethical concerns in research and intellectual contexts. **CO4**: Demonstrate knowledge of ethical values in internships and field work.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**		**50%**		**5%**
Examination Mode	Theory						
Syllabus	**Unit 1: (3 hours)** • Values and Ethics-An Introduction. • Goal and Mission of Life, Vision of Life. • Principles and Philosophy.						**CO1**
	Unit 2: (3 hours) • Self-Exploration. • Self-Awareness. • Self-Satisfaction						**CO2**
	Unit 3: (3 hours) • Decision Making, Motivation, • Sensitivity, Success, Selfless Service, • Case Study of Ethical Lives.						**CO3**
	Unit 4: (3 hours) • Positive Spirit, Body, Mind and Soul. • Attachment and Detachment. • Spirituality Quotient. Examination.						**CO4**
Reference Books	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	

Semester 3

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS211**						
Course Title	**Crop Production Technology-I (*Kharif* Crops)**						
Hours	36: L: 1, P: 2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Cultivation practices of cereal crops, their benefits, constrains in their production and their remedies. **CO2:** Cultivation practices of pulses their benefits, constrains in their production and their remedies. **CO3:** Cultivation practices of oil seeds their benefits, constrains in their production and their remedies. **CO4:** Cultivation practices of Fiber and Forage crops, their benefits, constrains in their production and their remedies.						
Examination Type	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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						**CO1**
	Unit 2: (3 hours) • 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;						**CO2**
	Unit 3: (3 hours) • Origin, geographical distribution, economic importance, soil						**CO3**

	and climatic requirements, varieties, cultural practices and yield of *Kharif* crops: • Cultivation practices of oilseed crops- sesame, groundnut, and soybean.	
	Unit 4: (3 hours) • 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- cowpea, cluster bean, napier hybrid and guinea grass	**CO4**
	Practical (24 hours) • Rice nursery preparation, • Transplanting of Rice, • Sowing of soybean, pigeonpea and mungbean, maize, groundnut and cotton, • Effect of seed size on germination and seedling vigour of *kharif* season crops, • Effect of sowing depth on germination of *kharif* crops, • Identification of weeds in *kharif* season crops, • top dressing and foliar feeding of nutrients, • Study of yield contributing characters and yield calculation of *kharif* season crops, • Study of crop varieties and important agronomic experiments at experimental farm, • Study of forage experiments, morphological description of *kharif* season crops, • Visit to research centres of related crops.	
Reference Books	1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi. 2. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India),Jodhpur 3. Singh, S.S. and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi. 4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set), Kalyani Publishers, New Delhi, Kalyani Publishers, Ludhiana. 5. Rathore, P.S. 2000. Techniques and Management of Field	

	Crop Production, Agrobios (India), Jodhpur.	

In Hours			
L	T	P	Credits
3	0	2	4

Course Code	**AGS212**						
Course Title	**Fundamentals of Plant Pathology**						
Hours	60 : L: 3, P: 2						
Credits	4						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To get aware about the different plant diseases and their nature. **CO2:** To get aware about fungal, bacterial diseases and mollicutes, their history, classification and identification. **CO3:** To get aware about the viral diseases their history, classification and identification. **CO4:** To get knowledge about how to control and manage the diseases by various practices.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (10 hours)** • 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. • Dispersal and survival of plant pathogens, epidemiology of plant pathogens.						**CO1**
	Unit 2: (10 hours) • General characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual).						**CO2**

	• 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 3: (4 hours) • **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.).	**CO3**
	Unit 4: (12 hours) • Defense mechanisms in plants. • Principles and methods of plant disease management. • Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.	**CO4**
	Practical (24 hours) • Acquaintance with various laboratory equipment 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 spraysconcentrations**.**	
Reference Books	1. Agrios, G.N. 1998. Plant Pathology, 3rd Edition Academic Press, New York. 2. Alexopolus, C.J. and Mims. 1989. Introductory Mycology,	

	Willey Eastern Ltd., New Delhi. 3. Alice, D., C. Jayalakshmi and K. Sethuraman. 2007. Hand Book on Introductory Plant Pathology, A.E. Publication, Coimbatore. 4. Mehrotra, R.S. 1990. An Introductions to Mycology, Willey Eastern Ltd., New Delhi. 5. Narayanasamy, P. 1997. Plant Pathogens and Detections and Diseases Control Oxford and IBH Publishing Co. Ltd, New Delhi. 6. Ciancio, A. and Mukerji, K.G. eds., 2007. General concepts in integrated pest and disease management. Springer. 7. Singh R S. 2008. Introduction to Principles of Plant Pathology. Oxford & IBH, New Delhi.	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 213**						
Course Title	**Agricultural finance and cooperation**						
Hours	48 L: 2, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To study about agricultural finance, agricultural credit their analysis and source of finance in agriculture. **CO2:** To know about finance institutions, e-banking and recent development in agricultural credit. **CO3:** Students will get to know the preparation and analysis of finance statements, SWOT analysis. **CO4:** Project appraisal techniques (Discounted measures and undiscounted measures), significance of co-operatives in Indian agriculture.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • Agricultural Finance- meaning, scope and significance, • Credit needs and its role in Indian agriculture. • Agricultural credit: meaning, definition, need, classification. • Credit analysis: 4 R's, 7P's and 3C's of credits. • Sources of agricultural finance: institutional and non-institutional sources, commercial banks. Supervisory credit systems, priority lending.						**CO1**
	Unit 2: (6 hours) • **S**ocial 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.						**CO2**

	• Recent development in agricultural credit.	
	Unit 3: (6 hours) • 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.	**CO3**
	Unit 4: (6 hours) • 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.	**CO4**
	Practical (24 hours) • Determination of most profitable level of capital use. • Optimum allocation of limited amount of capital among different enterprise. • Analysis of progress and performance of cooperatives using published data. • Analysis of progress and performance of commercial banks and RRBs using published data. • Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. • Estimation of credit requirement of farm business – A case study. • Preparation and analysis of balance sheet – A case study. Preparation and analysis of 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS214**						
Course Title	**Farm machinery and power**						
Hours	36: L: 1, P: 2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To get aware about the real status of farm power in India, knowledge about the I.C engine their working, principles and components. **CO2:** To get aware about the operation of tractor their parts and power attached implements. **CO3:** To get aware about the types of tractors, cost analysis and tillage implements. **CO4:** To get knowledge about the sowing, planting, harvesting, threshing and plant protection implements.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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.						**CO1**
	Unit 2: (3 hours) • 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.						**CO2**
	Unit 3: (3 hours) • Tractor types, Cost analysis of tractor power and attached implement,						**CO3**

	• Familiarization with primary and secondary tillage implement, implement for hill agriculture, implement for intercultural operations.	
	Unit 4: (3 hours) • 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.*	**CO4**
	Practical (24 hours) • 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.	
Reference Books	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	

In Hours			
L	T	P	Credits
1	0	4	3

Course Code	**AGS215**						
Course Title	**Principles of seed technology**						
Hours	60 L: 1, P: 4						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** The students will understand the importance of seed and seed technology in agriculture. They will learn seed production techniques in different crops, maintenance of seed purity during seed-production. **CO2:** To get aware about seed certification, seed act, seed tests, organic seed production and detection of GM crops. **CO3:** To get aware about the post- harvest handling of seeds from harvest to marketing, and control of pests during storage. **CO4:** The students will understand to get idea about seed-marketing in India, role of WTO and OECD in seed marketing.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**0**	**25%**	**25%**	**35%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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.						**CO1**
	Unit 2: (3 hours) • 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,						**CO2**

	• 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 3: (3 hours) • 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.	**CO3**
	Unit 4: (3 hours) • 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.	**CO4**
	Practical (48 hours) • 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.	
Reference Books:	1. Agarwal, R.L.1991.Seed Technology. Oxford & IBH Publishing Co. New 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	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS216**						
Course Title	**Production technology for vegetable and spices**						
Hours	36 L:1, P: 2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills to enable them to be agri - entrepreneur: **CO1:** Knowledge about the importance and scientific cultivation of solanaceous and cucurbitaceous vegetable crops **CO2:** Knowledge about the importance and scientific cultivation of leguminous and cole crops **CO3:** Knowledge about the importance and scientific cultivation of bulb and root crops **CO4:** Knowledge about the importance and scientific cultivation of tuber and leafy vegetable crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory/ Practical/ Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Importance of vegetables & spices in human nutrition and national economy • Classification of vegetables, types of vegetable gardens, • 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 Solanaceous and Cucurbitaceous vegetables						**CO1**
	Unit 2: (3 hours) • 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						**CO2**
	Unit 3: (3 hours)						**CO3**

	• 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 and root crops	
	Unit 4: (3 hours) • 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	**CO4**
	Practical (24 hours) • Identification of vegetables & spice crops and their seeds. • Nursery raising. • Direct seed sowing and transplanting. • Methods of planting of important vegetable crops. • Fertilizers applications. • Harvesting & preparation for market. • Economics of vegetables and spices cultivation.	
Reference Books	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.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 217**						
Course Title	**Statistical methods**						
Hours	36; L: 1, P: 2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To study about data, measures of central tendency and dispersion, probability theorems. **CO2:** To know about correlation and regression. **CO3:** Students will get to know preparation and analysis of tests of significance and sample test for mean. **CO4:** Study about techniques of ANONA, chi-square test student- t and f tests, sampling methods, simple random sampling, stratified sampling.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Agricultural Finance- meaning, scope and significance, Credit needs and its role in Indian agriculture. • Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, 7P's and 3C's of credits. • Sources of agricultural finance: institutional and non-institutional sources, commercial banks. Supervisory credit systems, priority lending.						**CO1**
	Unit 2: (3 hours) • 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.						**CO2**

	• Recent development in agricultural credit.	
	Unit 3: (3 hours) • 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.	**CO3**
	Unit 4: (3 hours) • 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.	**CO4**
	Practical (24 hours) • 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
3	0	2	4

Course Code	**AGS218**						
Course Title	**Livestock and poultry management**						
Hours	60 L: 3, P: 2						
Credits	4						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will come to know about role of livestock in enhancing national economy, developing and evaluating animal production. **CO2:** Management of different animal species, Important Indian and exotic breeds their improvement and **CO3:** Digestion and feeds in livestock and poultry, Feed stuffs and their classification, nutrients and ingredients of ration. **CO4:** Introduction, prevention and control of diseases.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**		**25%**		**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • 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.						**CO1**
	Unit 2: (10 hours) • 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.						**CO2**
	Unit 3: (7 hours) • Digestion in livestock and poultry.						**CO3**

	• 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 4: (9 hours) • Introduction of livestock and poultry diseases. • Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.	**CO4**
	Practical (24 hours) • 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 equipment. • Management of chicks, growers and layers. • Debeaking, dusting and vaccination. • Economics of cattle, buffalo, sheep, goat, swine and poultryproduction.	
Reference Books	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	

In Hours			
L	T	P	Credits
2	0	0	2

Course Code	**AGS219**						
Course Title	**Rural sociology and educational psychology**						
Hours	24 L: 2, P: 0						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** After this course, the students will know the characteristics of rural society, their importance, scope, significance and social groups. **CO2:** After this course, the students will know the social stratification, social institutions, cultural and social values. **CO3:** Students will get to know the educational psychology, agricultural extension, learning and teaching situation. **CO4:** Students will get to know the assessment of various personality types, emotions of human and motivation.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25**		**50%**		**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (5 hours)** • Sociology and Rural sociology: • Definition and scope, its significance in agriculture extension, • Social Ecology, Rural society, Social Groups.						**CO1**
	Unit 2: (6 hours) • Social Stratification, Culture concept, Social Institution, Social Change & Development.						**CO2**
	Unit 3: (5 hours) • Educational psychology: Meaning & its importance in agriculture extension. • Behavior: Cognitive, affective.						**CO3**

	Unit 4: (8 hours) • Psychomotor domain, Personality, Learning, Motivation, • Theories of Motivation, Intelligence.	**CO4**
Reference Books	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.	

In Hours			
L	T	P	Credits
0	0	4	2

Course Code	**AGS101**						
Course Title	**National Service Scheme- I**						
Hours	48 L; 0, P: 4						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: Participants will gain a clear understanding of the history, objectives, and organizational structure of NSS. **CO2**: Students will acquire skills to map community stakeholders, design culturally relevant messages, and engage in effective youth-adult partnerships for community mobilization. **CO3:** Participants will develop a deeper understanding of the issues, challenges, and opportunities faced by youth, recognizing their potential as agents of social change. **CO4**: Volunteers will gain an understanding of their fundamental rights and duties as citizens, as outlined in the Indian Constitution.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage		**20%**		**30%**		**50%**	
Examination Mode	Practical						
Syllabus	**Practical** **Unit 1: (12 hours)** • Introduction and basic components of NSS: Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health • NSS programmes and activities: Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary						**CO1**
	Unit 2: (12 hours)						**CO2**

	• Understanding youth: Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change • Community mobilisation: Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership	
	Unit 3: (12 hours) • Social harmony and national integration: Indian history and culture, role of youth in nation building, conflict resolution and peacebuilding • Volunteerism and shramdan: Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism	**CO3**
	Unit 4: (12 hours) • Citizenship, constitution and human rights: Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information • Family and society: Concept of family, community (PRIs and other community based organisations) and society	**CO4**
Reference Books	1. Naik, M. G. 2017. National Service Scheme (NSS): A Handbook for Volunteers. Directorate of NSS, Ministry of Youth Affairs and Sports, Government of India 2. Subramanian, K, S. 2007. Volunteering: A Guide for Young Volunteers. Global Vision Publishing House. 3. Rajan, S. Irudaya. 2012. Youth and Social Change in India. Sage Publications India Pvt Ltd 4. Basu D. D. 2015. Introduction to the Constitution of India. Prentice Hall of India Pvt. Ltd. Revised edition.	

In Hours			
L	T	P	Credits
0	0	4	2

Course Code	**PHE110**						
Course Title	**Physical Education & Yoga Practices- I**						
Hours	48 L; 0, P: 4						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: Develop proficiency in fundamental and advanced skills of Football, Basketball, Kabaddi, and Ball Badminton through demonstration, practice, and correction in game situations. **CO2**: Enhance game awareness and decision-making by applying learned skills in dynamic game situations, fostering the ability to adapt to various game scenarios. **CO3**: Master the rules and strategies of Football, Basketball, Kabaddi, and Ball Badminton, integrating these into practical gameplay to ensure rule-compliant and strategic participation. **CO4**: Improve coaching and teaching techniques for instructing others in these sports, with an emphasis on skill demonstration, correction, and fostering active involvement in the game.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage		**20%**		**30%**		**50%**	
Examination Mode	Practical						
Syllabus	**Practical** **Unit 1: (14 hours)** • Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit) • Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)						**CO1**

	• Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game	
	Unit 2: (12 hours) • Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation • Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game	**CO2**
	Unit 3: (12 hours) • Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation • Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation	**CO3**
	Unit 4: (10 hours) • Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game • Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation	**CO4**
Reference Books	1. Smith, Kieran. 2010. Football Skills and Drills. Human Kinetics 2. Wooden, John and Carty, Jay. 2005. The Complete Guide to Coaching Basketball. Hachette Books 3. Wilson, George H. 2003. Coaching Football: A Guide to the Game. McGraw-Hill Education 4. Krause, Jerry and Meyer, Don. 2004. Basketball Skills and Drills. Human Kinetics 5. Sharma, B. D. 2012. Kabaddi: A Complete Guide. National Book Trust 6. Chaurasia, Ashok. 2014. Modern Coaching: A Practical Guide to Coaching the Sport of Kabaddi. Sports Publications 7. Raju, V. K. S. 2015. The Complete Guide to Ball Badminton. Sports Publications 8. Kadian, S. K. 2011. Coaching Manual for Kabaddi. Kadian Publications	

Semester-4

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS221**						
Course Title	**Crop Production Technology –II (*Rabi Crops*)**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About various requirements and cultivation practices for *rabi* cereal crops **CO2-** About various requirements and cultivation practices for *rabi* oilseed crops **CO3-** About various requirements and cultivation practices for *rabi* medicinal and aromatic crops **CO4-** About various requirements and cultivation practices for *rabi* forage crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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.						**CO1**
	Unit 2: (3 hours) • Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops: Oilseeds-rapeseed, mustard, sunflower and sugar crops- sugarcane and sugar beet.						**CO2**
	Unit 3: (3 hours) • 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						**CO3**
	Unit 4: (3 hours) • Origin, geographical distribution, economic importance,						**CO4**

	soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops: Forage crops- berseem, lucerne and oat.	
	Practical (24 hours) • 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.	
Reference Books	1. Singh, Chhidda, Singh, Prem and Singh, Rajbir. 2003. Modern Techniques of Raising Field Crops, Oxford & IBH Publishing Co., New Delhi. 2. Singh, S.S. 1998. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi. 3. Panda, S.C. 2012. Modern Concepts and Advance Principles in Crop Production. Agrobios (India),Jodhpur 4. Singh, S.S. and Singh, Rajesh. 2013. Crop Management Under Irrigated and Rainfed Conditions. Kalyani Publishers, New Delhi. 5. Rathore, P.S. 2000. Techniques and Management of Field Crop Production. Agrobios (India), Jodhpur. 6. Prasad, Rajendra. 2002. Text Book of Field Crops Production. ICAR, New Delhi.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS222**						
Course Title	**Production Technology for Ornamental crops, MAPs and Landscaping**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About ornamental crops, MAPs and landscaping **CO2-** About production technologies for important cut and loose flowers **CO3**- About production technologies for medicinal plants **CO4**- About processing and value addition of the ornamental crops and MAPs						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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.						**CO1**
	Unit 2: (3 hours) • Production technology of important cut flowers like lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. • Package of practices for loose flowers like marigold and jasmine.						**CO2**
	Unit 3: (3 hours) • Production technology of important medicinal plants like ashwagandha, asparagus, aloe, Cinnamomum, isabgol.						**CO3**
	Unit 4: (3 hours) • Production technology of important aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum,						**CO4**

	• Processing and value addition in ornamental crops and MAPs produce.	
	Practical (24 hours) • Identification of Ornamental plants. • Identification of Medicinal and Aromatic Plants. • Nursery bed preparation and seed sowing. • Training and pruning of Ornamental plants. • Planning and layout of garden. • Planting methods for different MAPs. • 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.	
Reference Books	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.	

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In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS223**						
Course Title	**Renewable Energy and Green Technology**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About energy sources and their contribution in agriculture sector **CO2**- About biogas, bio-alcohol, bio-diesel and bio-oil **CO3**- About solar energy and its application **CO4**- About solar gadgets, wind energy and their application						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Classification of energy sources, contribution of these of sources in agricultural sector, familiarization with biomass utilization for biofuel production and their application.						**CO1**
	Unit 2: (3 hours) • 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.						**CO2**
	Unit 3: (3 hours) • Introduction to solar energy, collection and their application, familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy.						**CO3**
	Unit 4: (3 hours) • Solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction to wind energy and their application.						**CO4**

	Practical (24 hours) • 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.	
Reference Books	1. Tiwari, G. N. and Mishra Rajeev Kumar. 2012. Advanced Renewable Energy Sources. Royal Society of Chemistry	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS224**						
Course Title	**Manures, Fertilizers and Soil Fertility Management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About plant nutrition **CO2**- About organic manures **CO3**- About fertilizers **CO4**- About fertility management in soil						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (4 hours)** • 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.						**CO1**
	Unit 2: (2 hours) • Introduction and importance of organic manures, • Properties and methods of preparation of bulky and concentrated manures. • Green/leaf manuring.						**CO2**
	Unit 3: (6 hours) • Fertilizer recommendation approaches. Integrated nutrient management. • Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers,						**CO3**

	secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers • Soil amendments, Fertilizer Storage, Fertilizer Control Order.	
	Unit 4: (3 hours) • 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.	**CO4**
	Practical (24 hours) • 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.	
Reference Books	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. 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.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS225**						
Course Title	**Production Technology for Fruit and Plantation Crops**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About importance and scope of fruit and plantation crop and cultivation of major fruits **CO2**- About cultivation of stone fruits, walnut and almond **CO3**- About cultivation of minor fruits **CO4**- About cultivation of plantation crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (4 hours)** • 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.						**CO1**
	Unit 2: (2 hours) • Production technologies for the cultivation of stone fruits, walnut, almond.						**CO2**
	Unit 3: (3 hours) • Production technologies for the cultivation of minor fruits- date, ber, pineapple, pomegranate, jackfruit, small berry fruits.						**CO3**
	Unit 4: (3 hours) • Production technologies for the cultivation of plantation crops- coconut, arecanut, cashew, tea, coffee & rubber and integrated farming system with plantation crops and spices.						**CO4**

	Practical (24 hours) • Seed propagation. • Scarification and stratification of seeds. • Propagation methods for fruit and plantation crops. • Description and identification of fruit. • Important pests, diseases and physiological disorders of above fruit and plantation crops, • Visit to commercial orchards.	
Reference Books	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.	

In Hours			
L	T	P	Credits
1	0	0	1

Course Code	**AGS226**						
Course Title	**Farming System and Sustainable Agriculture**						
Hours	12 L: 1, P: 0						
Credits	1						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About basics of farming systems **CO2**- About cropping systems, their production and efficiencies **CO3**- About sustainable agriculture and techniques for sustainability **CO4**- About integrated farming systems						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**	**0**	**50%**	**0**	**5%**
Examination Mode	Theory						
Syllabus	**Unit 1: (3 hours)** • 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						**CO1**
	Unit 2: (3 hours) • 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						**CO2**
	Unit 3: (2 hours) • 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						**CO3**

	Unit 4: (4 hours) • 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.	**CO4**
Reference Books	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	

In Hours			
L	T	P	Credits
2	0	1	3

Course Code	**AGS227**						
Course Title	**Agriculture Marketing Trade & Prices**						
Hours	48 L: 2, P: 1						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About basic concepts of agriculture marketing **CO2**- About product life cycle and competitive strategies, pricing and promotional strategies, marketing process and functions **CO3**- About marketing channels, integration, efficiency, costs and price spread in market **CO4**- About Govt. role in agricultural marketing, agricultural prices, trade and policy						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (5 hours)** • 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.						**CO1**
	Unit 2: (6 hours) • Product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; • Characteristics of PLC; strategies in different stages of PLC; • Pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing;						**CO2**

	• 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 3: (5 hours) • 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.	**CO3**
	Unit 4: (8 hours) • 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.	**CO4**
	Practical (24 hours) • 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.	
Reference Books	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	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS228A**						
Course Title	**Soil and Water Conservation Engineering**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About soil and water conservation **CO2**- About soil erosion and soil loss measurement techniques **CO3**- About erosion control measures and water harvesting **CO4**- About wind erosion						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Introduction to soil and water conservation, causes of soil erosion. • Definition and agents of soil erosion, water erosion, forms of water erosion.						**CO1**
	Unit 2: (3 hours) • Stages of soil erosion. Gully: classification and control measures. • Soil loss estimation by Universal Soil Loss Equation (USLE). • Soil loss measurement techniques.						**CO2**
	Unit 3: (4 hours) • 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.						**CO3**
	Unit 4: (2 hours) • Wind erosion: mechanics of wind erosion, types of soil movement. • Principles of wind erosion and its control measures.						**CO4**

	Practical (24 hours) • 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.	
Reference Books	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 3. Jain, S.C. and Rai, C.R. 2008. Farm Tractor-maintenance and repair, Standard Publishing Distributers, New Delhi	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	EVS212						
Course Title	**Environmental Studies and Disaster Management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**- About natural resources such as forest, water, mineral, energy resources etc. **CO2**- About ecosystem and biodiversity **CO3**- About environmental pollution, social issues and population and environment **CO4**- About disasters and its management						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • 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.						**CO1**

	• 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 2: (6 hours) • 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.	**CO2**
	Unit 3: (6 hours) • 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,	**CO3**

	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 4: (6 hours) **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.	**CO4**
	Practical (24 hours) 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
0	0	4	2

Course Code	**AGS102**						
Course Title	**National Service Scheme- II**						
Hours	48 L; 0, P: 4						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: Develop effective youth leadership skills, and recognizing the importance and role of youth leadership in community development. **CO2**: Enhance life competencies, equipping students with the skills to navigate challenges and contribute positively to society. **CO3**: Gain insight into health, hygiene, and sanitation, and applying this knowledge to national health programs and reproductive health. **CO4**: Promote healthy living and self-care, and the integration of yoga practices to improve physical and mental well-being, while dispelling common myths about yoga.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage		**20%**		**30%**		**50%**	
Examination Mode	Practical						
Syllabus	**Practical** **Unit 1: (12 hours)** • 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						**CO1**

	Unit 2: (12 hours) • Youth development programmes: Development of youth programmes and policy at the national level, state level and voluntary sector; • Youth-focused and youth-led organisations	**CO2**
	Unit 3: (12 hours) • Health, hygiene and sanitation: Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health. • Youth health, lifestyle, HIV AIDS and first aid Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid	**CO3**
	Unit 4: (12 hours) • Youth and yoga History, philosophy, concept, myths and misconceptions about yoga; • Yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method	**CO4**
Reference Books	1. Naik, M. G. 2017. National Service Scheme (NSS): A Handbook for Volunteers. Directorate of NSS, Ministry of Youth Affairs and Sports, Government of India 2. Subramanian, K, S. 2007. Volunteering: A Guide for Young Volunteers. Global Vision Publishing House. 3. Rajan, S. Irudaya. 2012. Youth and Social Change in India. Sage Publications India Pvt Ltd 4. Basu D. D. 2015. Introduction to the Constitution of India. Prentice Hall of India Pvt. Ltd. Revised edition.	

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In Hours			
L	T	P	Credits
0	0	4	2

Course Code	**PHE130**						
Course Title	**Physical Education & Yoga Practices-II**						
Hours	48 L:0, T:0, P:4						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: About different field events **CO2**: About different asanas **CO3**: About weight and circuit training **CO4:** About calisthenics						
Examination Type	Practical						
Assessment Tools	Written Quiz	Lab performance	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (12 hours)** • Teaching of different field events – demonstration practice of the skills and correction. • Teaching of different field events – demonstration practice of the skills and correction with competition among them.						**CO1**
	Unit 2: (12 hours) • Teaching of different asanas – demonstration practice and correction.						**CO2**
	Unit 3: (12 hours) • Teaching of weight training – demonstration practice and correction. • Teaching of circuit training – demonstration practice and correction.						**CO3**
	Unit 4: (12 hours) • Teaching of calisthenics – demonstration practice and correction.						**CO4**

Elective Courses

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS229A**						
Course Title	**Agri-business Management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the students will be able **CO1:** To apply economic principles to analyse agribusiness sector, **CO2:** To use scientific methods in areas relevant to agribusiness and assess economic policy solutions to agricultural issues. **CO3:** To develop business plan or case study on topics relevant to agribusiness **CO4:** To demonstrate an understanding of the importance of impact of globalization and interdependencies of agri business sector.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • Transformation of agriculture into agribusiness, various stakeholders and components of agribusiness systems. • Importance of agribusiness in the Indian economy and New Agricultural Policy. • Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, • Classification of industries and types of agro based industries. • Institutional arrangement, procedures to set up agro based industries						**CO1**
	Unit 2: (6 hours) • Constraints in establishing agro-based industries. • Agri-value chain: Understanding primary and support activities and their linkages. • Business environment: PEST & SWOT analysis.						**CO2**

	• Management functions: Roles & activities, • Organization culture. • Planning, meaning, definition, types of plans. • Purpose or mission, goals or objectives, • Strategies, polices procedures, rules, programs and budget.	
	Unit 3: (6 hours) • 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 theirimportance.	**CO3**
	Unit 4: (6 hours) • 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	**CO4**
	Practical (24 hours) • Study of agri-input markets: Seed, fertilizers, pesticides. • Study of output markets: grains, fruits, vegetables, flowers. • Study of product markets, retails trade commodity trading, and value added products. • Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. • Preparations of projects and Feasibility reports for agribusiness entrepreneur. • Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. • Case study of agro-based industries. • Trend and growth rate of prices of agricultural commodities. • Net present worth technique for selection of viable project.	

	• Internal rate of return.	
Reference Books	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. Somani L. L. and Meena, G. L. 2017. Agribusiness & Farm Management at a Glance, Vol-2, Basic & Applied Fundamentals, Agrotech Publishing Academy, Udaipur, 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.	

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS229B**						
Course Title	**Agrochemicals**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the students will be able to **CO1-** Understand the role of various agrochemicals and their management for sustainable agriculture. **CO2-** Recognize various classes of fertilizers, fungicides, insecticides, herbicides and their importance in agriculture. **CO3-**Analyze the manufacturing of mixed and complex fertilizers, their logistics and marketing. **CO4-** Know the insecticide act and rules, fate of insecticides in soil and plants, insecticides banned, withdrawn and restricted use.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • 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. • Herbicides-Major classes, properties and important herbicides. • Fate of herbicides.						**CO1**
	Unit 2: (6 hours) • 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. • Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.						**CO2**

	Unit 3: (6 hours) • 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 anduses. • Plant bio-pesticides for ecological agriculture, Bio-insect repellent.	**CO3**
	Unit 4: (6 hours) • Fertilizers and their importance. • Nitrogenous fertilizers: Feed stocks 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.	**CO4**
	Practical (24 hours) • 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 kin market. • Estimation of nitrogen in Urea. • Estimation of water soluble P_2O_5 and citrate soluble P_2O_5 in	

	single super phosphate. • Estimation of potassium in Muraite 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.	
Reference Books	1. Vasantharaj David, B and Ramamurthy V. V. 2016. Elements of Economic Entomology. 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. 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.	

In hours			
L	T	P	Credits
1	0	4	3

Course Code	**AGS229C**						
Course Title	**Commercial Plant Breeding**						
Hours	60 L:1, T:0, P:4						
Credits	3						
Course Outcomes	On the completion of the course, the student will: **CO1**- Get acquainted with various types of crops and modes of plant reproduction, line development and maintenance. **CO2**- Develop an understanding of varietal testing, release and notification system in India. **CO3**- Be able to apply conventional and advance seed production techniques in important field crops and, **CO4**- To compare different classes of seed as per purity, DUS testing, source and generation system.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**		**25%**	**25%**	**35%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** Types of crops and modes of plant reproduction. Line development and maintenance breeding in self- and cross-pollinated crops (A/B/R and two-line system) for development of hybrids and seed production.						**CO1**
	Unit 2: (3 hours) 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.						**CO2**
	Unit 3: (3 hours) Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools.						**CO3**

	IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FRAct.	
	Unit 4: (3 hours) 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.	**CO4**
	Practical (48 hours) • 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.	
Reference Books	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.	

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS229D**						
Course Title	**Landscaping**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the students will be able **CO1**- Understand the concepts, importance and scope of landscaping. **CO2-** Develop ability to identify various garden styles, types and its components. **CO3-** To analyze various factors influencing landscaping and gardening. **CO4-** To make outline and planning of landscaping of urban, rural areas, bonsai and lawn establishment.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • 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 specialpurposes.						**CO1**
	Unit 2: (6 hours) • Trees: selection, propagation, planting schemes, canopy management, • Shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. • Climber and creepers: importance, selection, propagation,planting.						**CO2**
	Unit 3: (6 hours) • Annuals: selection, propagation, planting scheme, • Other garden plants: palms, ferns, grasses and cacti succulents.						**CO3**

	Pot plants: selection, arrangement, management. • Bio-aesthetic planning: definition, need, planning; • Landscaping of urban and rural areas, peri-urban landscaping.	
	Unit 4: (6 hours) • 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.	**CO4**
	Practical (24 hours) • 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.	
Reference Books	1. Bose, T. K., Maiti, R. G., Dhua, R. S. & Das, P. 1999. Floriculture and Landscaping. Naya Prakash. 2. Chadha, K. L. & Chaudhury, B. 1992. Ornamental Horticulture in India. ICAR. 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.	

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS229E**						
Course Title	**Introduction to Protected Cultivation**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	Elective Course						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: 1. To teach students about protected cultivation, its scope and types 2. To teach students about soil and irrigation management 3. To teach students about production and propagation of quality planting material 4. To teach students about cultivation of important horticultural crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • Protected cultivation- importance and scope, • Status of protected cultivation in India and world. • Types of protected structures based on site and climate. • Cladding material involved in greenhouse/ poly house. • Greenhouse design, environment control, artificial lights, Automation.						**CO1**
	Unit 2: (8 hours) • 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.						**CO2 & CO3**
	Unit 3: (8 hours) • Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.						**CO4**

	• Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.	
	Practical (24 hours) • 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.	
Reference Books	1. Singh D K and Peter V K (2013), Protected Cultivation of Horticultural Crops Seeds. NIPA. 2. Swain S C (2014) Precision Farming in Horticulture: Approaches and Strategies. Narindra Publishing House. 3. Henderson, S.M. and R.L. Perry (1955). Agricultural Process Engineering. John Willy and Sons, New York.	

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS229F**						
Course Title	**Introduction to Beekeeping**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type							
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** About beekeeping **CO2:** About various products from honey bee **CO3:** About nutritional significance and bee flora **CO4:** About management of diseases and enemies of honey bees						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • History of beekeeping; • Classification of bees; honey bee species. • Morphology, anatomy, life cycle, colony organization and division of labour in honey bees. • Economic importance of honeybees.						**CO1**
	Unit 2: (8 hours) • Honey bees as pollinators and • Study of various honeybee products such as honey, royal jelly, pollens, wax, venom. • Nutritional significance of various products of honey bees. • Basic requirements to start beekeeping.						**CO2 & CO3**
	Unit 3: (8 hours) • Study of bee flora and its availability. • Study of symptoms, nature of damage and management of bee diseases. • Bee enemies: Life cycle, seasonal history, nature of damage and their management.						**CO4**

	Practical (24 hours) • Identification of different species and castes of honeybees. • Study of morphology of Italian honeybee, *Apis mellifera* with respect to head, thorax and abdomen; fore-, middle- and hind legs; mouth parts; fore and hind wings; poison glands etc. • Study of internal organs of honey bee, specifically the honey stomach as part of the alimentary canal and pharyngeal glands. • Study of foraging behaviour of honey bees. • Acquaintance with nectar, pollen, apicultural equipment and machinery. • Visit to apiaries and industrial set up to familiarize students with the process of beekeeping and products of honey bees.	
Reference Books	1. Singh, S., 1975.Bee keeping in India – ICAR, New Delhi., 214p. 2. Sunita, N.D, Guled, M.B, Mulla, S.R and Jagginavar, 2003, Beekeeping, UAS Dharwad 3. Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur. 4. Singh, D. and Singh, D.P. 2006. A Hand Book of Beekeeping, Agrobios (India). 98 5. Paul De Bach and Devid Rosen 1991. Biological control by natural enemies. Cambridge University	

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS229G**						
Course Title	Introduction to Mushroom Cultivation						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** About edible and poisonous fungi **CO2:** About basic requirements of growing mushroom **CO3:** About cultivation techniques of edible mushroom **CO4:** About spawn and its preparation						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • Taxonomic classification, nomenclature and important feature of edible fungi, distinction between edible and poisonous taxa and characters of poisonous varieties of mushrooms.						**CO1**
	Unit 2: (8 hours) • Nutritional, physiological and ecological parameters for growing edible variety of mushroom. Cultivation technology of edible varieties of mushrooms including substrate pre-treatment, its preparation, composting methodologies.						**CO2 & CO3**
	Unit 3: (8 hours) • Spawn types and preparation of spawn, growing methodologies of different varieties of mushrooms for small, medium and commercial scale and crop management practices.						**CO4**
	Practical (24 hours) • Methodology of substrate pre-treatment, preparation and composting of substrate, • Master culture and spawn preparation techniques, • Cultivation methodology for commonly cultivated varieties of mushrooms and post-harvest shelf life of these mushrooms.						

	• Visit to mushroom industry.	
Reference Books	1. B. C. Suman and V.P. Sharma. 2007. Mushroom cultivation in India, Daya Books, New Dehli. 2. Agrios GN.2005. Plant Pathology. 5th edition. Academic Press, New York. 3. V.P. Sharma. 2011. Diseases and pest of mushrooms. Agribios, India.	

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS229H**						
Course Title	**Introduction to Non-conventional Farming**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** About non-conventional farming systems **CO2:** About organic farming **CO3:** About various considerations in organic farming & hydroponics **CO4:** About novel farming techniques						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • Concept principles and different methods of non-conventional farming system. • Organic Farming: Introduction, production requirements, introduction, recycling of organic residues. • Use of biocontrol agents and biopesticides.						**CO1 & CO2**
	Unit 2: (8 hours) • Quality considerations - certification, labeling and accreditation, processors, marketing and exports. • Hydroponics, aeroponics, aquaponics: Meaning, significance and basic methods of hydroponics.						**CO3**
	Unit 3: (8 hours) • Importance, concepts and procedures for Trough Culture; • Urban and Peri-urban Farming. • Green House farming permaculture, vertical growing and aquaculture.						**CO4**
	Practical (24 hours) • Raising of crops following defined practices for raising organic crops with special reference in put materials such as fertilizers and pesticides. • Vermicomposting and green manuring.						

	• Familiarization with the different types of Hydroponic system- NFT – Nutrient Film Technique, DFT – Deep Flow Technique, Ebb & Flow, Wick System, Drip method, Aeroponics and their pros and cons. • Green house structure and functioning. Field visits in the rea of interest.	
Reference Books	1. Biswas R. K (2014) Organic Farming in India. ND Publishers, New Delhi. 2. Bansal, M (2010). Basics of Organic Farming, Cloudtail India. 3. Mason J (2004). How to grow different plants in hydroponics. A Viacom Company 4. Hansen G (2019) Aeroponics Gardening: The perfect guide to small and large scale Aeroponics.	

Semester 5

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 311**						
Course Title	**Principles of Integrated Pest and Disease Management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Improved knowledge regarding concepts like IPM, ETL,EIL **CO2:** Understand different methods of controlling insect-pests and diseases **CO3:** Learn different survey methods of insects-pests and diseases **CO3:** Developed entrepreneurship skills regarding insecticides and pesticides						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • 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.						**CO1**
	Unit 2: (6 hours) • 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.						**CO2**
	Unit 3: (6 hours)						**CO3**

	• 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	
	Unit 4: (6 hours) • Implementation and impact of IPM • Safety issues in pesticide uses • Political, social and legal implication of IPM • Case histories of important IPM programmes.	**CO4**
	Practical (24 hours) • Methods of diagnosis and detection of various insect pests, and plant diseases • Methods of insect pests and plant disease measurement • Assessment of crop yield losses • calculations based on economics of IPM • Identification of biocontrol agents, different predators and natural enemies • Mass multiplication of *Trichoderma*, *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	
Reference Books	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. 2017. Fungicides in plant disease control. Med Tech Publisher 4. Chattopadhyay, S.B. 1980. Principles and procedures of plant protection. Oxford & IBH Publishing Company.	

In Hours			
L	T	P	Credits
2	0	0	2

Course Code	**AGS 312**						
Course Title	**Problematic soils and their management**						
Hours	24 L:2, T:0, P:0						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Awareness about methods to identify problematic soil **CO2:** Learn to setup a plan for their reclamation and their post- reclamation management **CO3:** Learn about use of remote sensing and GIS in identification and management of problematic soils **CO4:** Learn about bio-remediation by trees						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**10%**	**25%**	**0**	**50%**	**0**	**5%**
Examination Mode	Theory						
Syllabus	**Unit 1: (5 hours)** • Soil quality and health, • Distribution of Waste lands and problematic soils in India, their categorization based on properties • Problematic soils under different Agro-ecosystems						**CO1**
	Unit 2: (7 hours) • 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.						**CO2**
	Unit 3: (6 hours) • Irrigation water – quality and standards, • utilization of saline water in agriculture • Remote sensing and GIS in diagnosis and management of						**CO3**

	problem soils.	
	Unit 4: (6 hours) • Multipurpose tree species, bio-remediation through MPTs of soils, • Land capability and classification, • Land suitability classification.	**CO4**
Reference Books	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, DCUSA	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 313**						
Course Title	**Pests of crops and stored grain and their management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Core Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: Understand the nature, types of damage, identification of key pests, and develop strategies for managing arthropod pests in field crops **CO2**: Understand the nature, types of damage, identification of key pests, and develop strategies for managing arthropod pests in vegetable crop, fruit crop, plantation crops **CO3**: Understand the nature, types of damage, identification of key pests, and develop strategies for managing arthropod pests in ornamental, condiments and spices. **CO4**: Learn about the various pests associated with stored grain and explore appropriate management practices for each.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • 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 crops						**CO1**
	Unit 2: (6 hours) • General account on nature and type of damage by different arthropod pests • Scientific name, order, family, host range, distribution,						**CO2**

	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 3: (6 hours) • 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	**CO2**
	Unit 4: (6 hours) • 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	**CO3**
	Practical (24 hours) • 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 314**						
Course Title	**Diseases of field and horticultural crops and their management -I**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: Identify and understand the symptoms, causes, and management practices for various fungal, bacterial, and viral diseases affecting key crops **CO2**: Develop practical knowledge in diagnosing common plant diseases and apply effective disease control strategies. **CO3**: Gain proficiency in integrated pest and disease management (IPM) techniques tailored to specific crops, ensuring sustainable and efficient crop production. **CO4**: Enhance the ability to recommend preventive and curative measures for plant diseases, contributing to improved crop health and yield quality.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** Symptoms, etiology, disease cycle and management of major diseases of following 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 • Cotton: anthracnose, vascular wilt, black arm, bacterial leaf blight and cotton leaf curl.						**CO1**
	Unit 2: (6 hours) Symptoms, etiology, disease cycle and management of major diseases of following crops:						**CO1**

	• Soybean: *Rhizoctonia* blight, bacterial spot, *Phytophthora* root rot, rust, cyst nematode, and mosaics • 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 3: (6 hours) Symptoms, etiology, disease cycle and management of major diseases of following 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	**CO2**
	Unit 4: (6 hours) Symptoms, etiology, disease cycle and management of major diseases of following crops: • Brinjal: Phomopsis blight, fruit rot, *Sclerotinia* blight and little leaf • 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	**CO2**
	Practical (24 hours) • 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.	
Reference Books	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	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 315**						
Course Title	**Crop Improvement-I (*Kharif* crops)**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** about centres of origin, wild relatives and their importance in producing new varieties of different *Kharif* crops **CO2:** understand major breeding objectives of various *Kharif* crops **CO3:** to learn about the procedures for developing improved varieties in different *Kharif* crops **CO4:** to learn hybrid seed production technology in various *Kharif* crops						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	Symptoms, etiology, disease cycle and management of major diseases of following crops: **Unit 1: (3 hours)** • 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						**CO1**
	Unit 2: (3 hours) • Study of genetics of qualitative and quantitative characters • Important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops, major breeding objectives						**CO2**
	Unit 3: (3 hours) • Breeding 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)						**CO3**

	Unit 4: (3 hours) • Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeon pea, etc. • Ideotype concept and climate resilient crop varieties for future.	**CO4**
	Practical (2 hours) • 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.	
Reference Books	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	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 316**						
Course Title	**Entrepreneurship development and business communication**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Understanding basic concepts and Government policy and programs in the area of entrepreneurship. **CO2:** Understanding impact of economic reforms on agri- business, entrepreneurial development process and business development skills **CO3:** Develop and strengthen the entrepreneurial quality, i.e., motivation or need for achievement. **CO4:** Analyze environmental setup relating to small industry or small business.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	Symptoms, etiology, disease cycle and management of major diseases of following crops: **Unit 1: (3hours)** • Concept of entrepreneur, entrepreneurship development, characteristics of entrepreneurs • SWOT analysis & achievement motivation • Government policy and programs, and institutions for entrepreneurship development.						**CO1**
	Unit 2: (3 hours) • Impact of economic reforms on Agribusiness/ Agri enterprises • Entrepreneurial development process • Business leadership skills, developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation)						**CO2 & CO3**
	Unit 3: (3 hours) • Developing managerial skills, business leadership skills						**CO4**

	(Communication, direction and motivation Skills), problem solving skill • Supply chain management, value chain, Block chain • Total quality management, sales promotion techniques	
	Unit 4: (3 hours) • Project planning formulation and report preparation • Financing of enterprise, opportunities for agri-entrepreneurship and rural enterprises • Incubators and start-ups	**CO5**
	Practical (24 hours) • Assessing entrepreneurial traits • problem solving skills • managerial skills • 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 317**						
Course Title	**Geoinformatics and Nano-technology and Precision farming**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** to create awareness about various application of geoinformatics and nanotechnology for precision agriculture **CO2:** To learn about soil mapping and remote sensing concepts **CO3:** Understanding the GPS and crop simulation models **CO4:** To learn about various nanotechnology techniques for scaling up farm productivity						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	Symptoms, etiology, disease cycle and management of major diseases of following crops: **Unit 1: (3 hours)** • Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture • Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture						**CO1**
	Unit 2: (3 hours) • 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						**CO2**
	Unit 3: (3 hours) • Global positioning system (GPS), components and its						**CO3**

	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 4: (3 hours) • 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	**CO4**
	Practical (24 hours) • 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	
Reference Books	1. Krishna, K.K. 2013. Precision Farming: Soil Fertility and Productivity Aspects. Apple Academic Press. 2. Srivastava, G.S. 2014. An Introduction to Geoinformatics. McGrew Hill Education (India) Pvt. Ltd., New Delhi 3. Gupta, R.K. and Subhash Chander. 2008. Principles of Geoinformatics. Jain Brothers, New Delhi	

In Hours			
L	T	P	Credits
0	1	4	2

Course Code	**AGS 318**						
Course Title	**Practical crop production-I (*Kharif* crops)**						
Hours	48 L:0, T:1, P:4						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Understand the principles of crop planning and its significance in agricultural productivity and economic sustainability. **CO2**: Gain hands-on experience in managing field crops, including sowing, irrigation, pest management, harvesting, and post-harvest practices. **CO3**: Apply knowledge of financial management to assess the cost of cultivation, prepare balance sheets, and calculate net returns in agricultural ventures. **CO4**: Develop the ability to make informed decisions on cropping systems, resource management, and market strategies to optimize crop production and profitability.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1 (6 hours)** • Crop Planning: Importance of crop planning in agriculture, factors influencing crop planning (climate, soil type, market demand, etc.), • Types of cropping systems: monocropping, intercropping, and crop rotation. • Crop Selection and Calendar: Criteria for selecting crops based on region and market conditions. • Seasonal crop planning: *Kharif*, *Rabi*, and *Zaid* seasons.						**CO1**
	Unit 2 (18 hours) • Field Preparation: Field preparation techniques: plowing, harrowing, and levelling, tools and equipment used in field preparation. • Seed Treatment & Nursery Raising: Seed treatment and methods of nursery raising for *Kharif* crops						**CO2**

	• Sowing and Crop Establishment: Sowing methods: broadcasting, drilling, and transplanting, seed rate and plant spacing • Nutrient Management: Fertilizers and organic matter application, macronutrients and micronutrients in crop production. Integrated nutrient management strategies. • Water Management: Irrigation methods: surface, drip, and sprinkler. Water use efficiency and scheduling. • Weed Management: Identification and control of weeds. Herbicide use and integrated weed management. • Management of Insect-Pests & Diseases: Integrated pest management (IPM) strategies. Common pest and disease identification and control.	
	Unit 3 (12 hours) • Harvesting: Indicators for harvesting at the right time. Harvesting techniques for different *kharif* crops. • Threshing & Winnowing: Methods of threshing for different types of crops. Winnowing and its role in grain cleaning. • Drying: Drying crops post-harvest. Drying methods and machinery. • Storage: Proper storage conditions and techniques. Handling of crop produce. • Marketing of Produce: Understanding market trends and pricing. Direct marketing and farmer organizations.	**CO3**
	Unit IV (12 hours) • Preparation of Balance Sheet: Components of a balance sheet. Assets, liabilities, and equity for crop production. • Cost of Cultivation: Direct and indirect costs involved in crop production. Cost estimation for field preparation, seed, fertilizers, irrigation, and labor. • Net Returns Calculation: Formulae for calculating gross and net returns. Break-even analysis and profitability. • Balance Sheet Preparation: Group work to prepare balance sheets for a crop management scenario. Discussion of net returns per student/team	**CO4**
Reference Books	1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition). Agri-Horticultural Publishing House, Nagpur. 2. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy (2nd edition). 3. 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,	

In Hours			
L	T	P	Credits
1	0	0	1

Course Code	**AGS-319**						
Course Title	**Intellectual property rights**						
Hours	12 L: 1, T: 0, P: 0						
Credits	1						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will develop skills to understand concept of IPR and will get the procedural knowledge of legal system in India related to it **CO2:** To know establishment of legal consultancies and service provision, patenting trade secrets and related things. **CO3:** They will be introduced to UPOV for protection of plant varieties, plant breeder rights and rights of traditional knowledge (TK) holders. **CO4:** To learn about Indian Biological Diversity Act, 2002						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**	**0**	**50%**	**0**	**5%**
Examination Mode	Theory						
Syllabus	**Unit 1: (2 hours)** • 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						**CO1**
	Unit 2: (5 hours) • 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						**CO2**
	Unit 3: (5 hours)						**CO3**

	• 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 4: (3 hours) • 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	**CO4**
Reference Books	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. 3. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation. 4. Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.	

Elective Courses

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 310A**						
Course Title	**Food Safety and Standards**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Understand the concept and application of food safety **CO2:** Familiarize the regulation associated with food safety **CO3:** Understand the best practices for management of food hazards and their impact on health **C04:** Learn about sampling and analytical techniques for evaluating the food quality						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • 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						**CO1**
	Unit 2: (6 hours) • 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.						**CO2**

	• ISO series. • TQM - concept and need for quality, components of TQM, Kaizen. Risk Analysis.	
	Unit 3: (6 hours) • 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.	**CO3**
	Unit 4: (6 hours) • 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.	**CO4**
	Practical (24 hours) 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.	
Reference Books	Jain, Akalank Kumar and Jain Vidhi, 2015. Food Safety and Standards Act, (Rules & Regulations) Akalank Publications	

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 310B**						
Course Title	**Biofertilizers and biopesticides**						
Hours	48 L:2, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** students will understand the need for utilising biofertilizers and biopesticides in agriculture **CO2:** student will also study the preparation of mass production technology **CO3:**students to think about the pros and cons of new technology **CO4:** production technology of biofertilizers and their marketing						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • History and concept of biopesticides. • Importance, scope and potential of biopesticide. • Definitions, concepts and classification of biopesticides *viz*. pathogen, botanical pesticides, and biorationales. • Botanicals and their uses. • Mass production technology of bio-pesticides. • Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.						**CO1**
	Unit 2: (4 hours) • Methods of application of biopesticides. • Methods of quality control of biopesticides. • Impediments and limitation in production and use of biopesticide.						**CO2**
	Unit 3: (6 hours) • Biofertilizers - Introduction, status and scope.						**CO3**

	• Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; • Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and • fungal biofertilizers- AM mycorrhiza and ectomycorhiza. • Nitrogen fixation -Free living and symbiotic nitrogen fixation. • Mechanism of phosphate solubilization and phosphate mobilization, K solubilization.	
	Unit 4: (6 hours) • Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertiizers. • FCO specifications and quality control of biofertilizers. • Application technology for seeds, seedlings, tubers, sets etc. • Biofertilizers - Storage, shelf life, quality control and marketing. • Factors influencing the efficacy of biofertilizers.	**CO4**
	Practical: (24 hours) • Isolation and purification of important biopesticides: *Trichoderma Pseudomonas*, *Bacillus*, *Metarhyzium* etc. and its production. • Identification of important botanicals. • Visit to biopesticide laboratory in nearby area. • Field visit to explore naturally infected cadavers. • Identification of entomopathogenic entities in field condition. • Quality control of biopesticides. • Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria. • Mass multiplication and inoculums production of biofertilizers. • Isolation of AM fungi -Wet sieving method and sucrose gradient method. • Mass production of AM inoculants. • Characterization and delineation of model watershed.	
Reference Books	1. Purohit SS 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	

	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)	

In hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 310C**						
Course Title	**Protected Cultivation**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: about protected cultivation, its scope and types **CO2**: about irrigation management, production and propagation of quality planting material in protected cultivation **CO3**: about cultivation of important horticultural crops **CO4**: about cultivation of medicinal and aromatic plants, and offseason production of vegetables and flowers						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • Protected cultivation- importance and scope, • Status of protected cultivation in India and world. • Types of protected structures based on site and climate. • Cladding material involved in greenhouse/ poly house. • Greenhouse design, environment control, artificial lights, Automation.						**CO1**
	Unit 2: (6 hours) • 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.						**CO2**
	Unit 3: (6 hours) • Greenhouse cultivation of important horticultural crops- rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium,						**CO3**

	tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc.	
	Unit 4: (6 hours) • Greenhouse cultivation of economically important medicinal and aromatic plants. • Off-season production of flowers and vegetables. • Insect pest and disease management.	**CO4**
	Practical (24 hours) • 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	
Reference Books	1. Singh D K and Peter V K (2013), Protected Cultivation of Horticultural Crops Seeds. NIPA. 2. Swain S C (2014) Precision Farming in Horticulture: Approaches and Strategies. Narindra Publishing House. **3.** Henderson, S.M. and R.L. Perry (1955). Agricultural Process Engineering. John Willy and Sons, New York.	

In Hours			
L	T	P	Credits
1	0	4	3

Course Code	**AGS 310D**						
Course Title	**Micro propagation Technologies**						
Hours	48 L:1, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** about history and basic concept of tissue culture **CO2:** about various type of culture **CO3:** about micropropagation and their stages **CO4:** about cell suspension and production of secondary metabolites						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Introduction, history and advantages of plant tissue culture. • Organization of plant tissue culture laboratory, culture media and PGRs used in plant tissue culture.						**CO1**
	Unit 2: (3 hours) • Basic concepts of plant tissue culture. Various types of cultures (cell, callus, organ, embryo and seed). Somaclonal variations.						**CO2**
	Unit 3: (3 hours) • Micropropagation, Stages of micropropagation. Axillary bud proliferation, organogenesis, somatic embryo, somatic embryogenesis						**CO3**
	Unit 4: (3 hours) • Cell suspension cultures, • Production of secondary metabolites and cryopreservation						**CO4**
	Practical (36 hours) • Various equipment's 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.	
Reference Books	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	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 310E**						
Course Title	**Principles and Practices of protected cultivation**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To learn the basic concepts about protected structures **CO2:** To know about humidity and fertigation management in protected structures **CO3:** To understand the preparation and selection of various materials for protected structures						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • Principles of constructing various protected structures • Greenhouse effect • Components of green house and detailed specification • Basic concepts to construct various protected structures i.e. Automated Green House, Poly houses, Poly tunnels, Shade net house and Trenches						**CO1**
	Unit 2: (8 hours) • Cooling and heating system • Ventilation system and humidity management in green house • Arrangement of pots, benches, protrays etc						**CO2**

	• Irrigation systems and fertigation management for protected cultivation	
	Unit 3: (8 hours) • Preparation of artificial growing media and its sterilization for protected cultivation • Arrangement and preparation of growing beds for various protected structures • Selection of various cladding materials for protected structures	**CO3**
	Practical (24 hours) • Identification and application of various cladding materials for protected structures. • Construction and management of low-cost poly houses. • Instalment and maintenance of cooling and heating system under greenhouse. • Cost estimation of automated green house. • Construction and cost estimation of poly house and tunnels. • Care and maintenance of irrigation and fertigation system under polyhouse.	
Reference Books	1. Anonymous, 2011. Technical standards for naturally ventilated, fan green house and shade net house, NHB, Gurgaon- Haryana (E- Book) 2. http://www.fao.org/3/a-i3284e.pdf(E- Book) 3. http://horticulture.ap.nic.in/Section%20wise/MIDH/Documents/P_C ELINES.pdf (E- Book). 4. http://rvskvv.net/images/New-Age-Protected-Cultivation_20.04.2020.pdf.(E- Book) 5. https://www.researchgate.net/publication/267342460_Micrometeo al_Principles_of_Protected_Cultivation.(Article) 6. https://www.researchgate.net/publication/330039167_PROTECTED_ VATION_OF_ORNAMENTALS (Article). 7. Michael, A.M. and T. P. Ojha. 1993, Principles of Agricultural Engin Vol. I. Jain Brothers, New Delhi.	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 310F**						
Course Title	**Principles and Practices of bee-keeping**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To study the life cycle, colony multiplication and seasonal management of honey bee colonies **CO2:** To know about the properties of honey, collection and storage of pollens **CO3:** To understand the management of bee diseases and bee enemies						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • Life cycle of *Apismellifera*, its colony organization and division of labour in honey bees • Colony multiplication and seasonal management of honey bee colonies • Swarming, absconding, robbing and drifting management						**CO1**
	Unit 2: (8 hours) • Physical and chemical properties of honey; its production, extraction, processing, packaging, transportation and uses • Collection, processing and storage of pollen, propolis, bees wax, bee venom, bee brood and royal jelly						**CO2**

	Unit 3: (8 hours) • Mass queen rearing technology • Stationary and migratory beekeeping • Management of bee diseases and bee enemies. Use of honey bee colonies for pollination	**CO3**
	Practical (24 hours) • Requirements for starting beekeeping. • Management of *Apismellifera* colonies in different seasons. • Collection, extraction and processing of honey. • Study of bee behaviour while visiting the apiaries. • Visits to the beekeeping industry to study hive manufacturing, bee equipment manufacturing, honey processing, packaging, and its commercial export.	
Reference Books	1. Singh, S., 1975.Bee keeping in India – ICAR, New Delhi., 214p. 2. Sunita, N.D, Guled, M.B, Mulla, S.R and Jagginavar, 2003, Beek UAS Dharwad 3. Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apic Agrobios, Jodhpur. 4. Singh, D. and Singh, D.P. 2006. A Hand Book of Beekeeping, Ag (India). 98 **5.** Paul DeBach and Devid Rosen 1991. Biological control by natural enemies. Cambridge University Press; 2 edition (27 June 1991)	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 310G**						
Course Title	**Principles and Practices of mushroom cultivation**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To study about the compost preparation **CO2:** To know about the spawn preparation for mushroom cultivation **CO3:** To understand the harvesting practices of mushroom						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • Preparation & pasteurization of the compost necessary to cultivate mushrooms • Selection of appropriate materials to prepare the compost-base materials from various agricultural by-products						**CO1**
	Unit 2: (8 hours) • Identify different types of compost- natural & synthetic • formulation of different compost • Composting in mushroom cultivation-short and long methods • casing and spawn preparation for mushroom cultivation • Disease control and pest management in cultivation						**CO2**
	Unit 3: (8 hours)						**CO3**

	• Harvesting of mushroom: Assessment of the maturity of mushroom and harvest periods • application of good harvesting practices cut, clean and dry harvested mushroom using approved procedures sort and grade the harvests as per required quality specifications	
	Practical (24 hours) • Composting in mushroom cultivation (button and oyster)-preparation and pasteurization, selection of commercially important types of Mushroom's spawn • package of practices of White button Mushroom and Oyster Mushroom • Inspection of Mushroom bags or beds for early detection of pests and diseases • Methods of harvesting of mushrooms.	
Reference Books	1. B.C. Suman and V.P. Sharma. 2007. Mushroom cultivation in India, Daya Books, New Delhi 2. Agrios G. N. 2005. Plant pathology. 5th edition, Academic Press, New York. 3. V. P. Sharma. 2011. Diseases and pest of mushrooms, Agribios, India.	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 310H**						
Course Title	**Principles and Practices of non-conventional farming**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To study about the non-conventional farming **CO2:** To know about the concept and methods of organic crop production **CO3:** To understand the concept of hydroponics						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** • Non-conventional farming- importance, classification and scope • Organic farming – status, strategies to promote, often debated issues • Organic manures - definition, advantages and disadvantages, characteristics of a good organic manure • FYM, compost, vermicompost – principles, resources available, essential requirements, different stages occurring during the process of organic manures and chemical composition						**CO1**
	Unit 2: (8 hours) • Organic crop production requirements - nutrient management, limiting nutrient losses						**CO2 & CO3**

	• Green manuring – classification, crops, advantages and disadvantages • Mulching - role, scope, advantages and disadvantages, different types of mulches, soil solarisation effect of mulching • Bio-fertilizer - classification, benefits, use in agriculture crops and future scope • Organic methods of weed control – cultural, mechanical	
	Unit 3: (8 hours) • Soilless Cultivation - definition, importance, scope, classification • Hydroponics - nutrient solutions, growing medium, nutritional disorders, diseases and pest control • Hydroponic production practices of tomatoes, cucumber, capsicum, Chrysanthemum and rose	**CO4**
	Practical (24 hours) • A field visit to the University organic farming fields; • Preparation and maintenance of different organic manures • Comparisons of different organic manures in terms of chemical composition (N) and response to crops • Comparison between organic and conventional farming in relation to yield, quality and soil fertility • Grow green manure crop and compare the nutrients requirement of crops with and without green manuring • Use of mulches and its effect on weeds, yield and quality • Organic produce processing, storage, and transportation • Weed management in organic farm • Growing of vegetable crops such as tomato, cucumber, capsicum etc. in soilless culture • Visit to progressive farmers' fields practicing non-conventional and organic farming.	

Reference Books	1. Anand, B. Masthihole and Nalina, L. (2020) Organic Farming. *www.Agrimoon.Com* . 2. Biswas, Rajendra Kumar (2014) Organic Farming in India, ND Publishers, New Delhi 3. George F. Van Patton (2004) Hydroponics Basics. Van Patton Publishing, USA. 4. Mishra, Sanjay and Mishra, R. L. (2017) Soilless Production. Daya Publishing House, New Delhi.	

Semester-6

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 320**						
Course Title	**Rainfed Agriculture and Watershed Management**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: understand the fundamentals of rainfed agriculture, including its history, types, and the role of watersheds in India's agricultural landscape. **CO2**: analyze the challenges and opportunities in rainfed agriculture, and develop strategies for improving productivity in these regions. **CO3**: gain knowledge on drought impacts, crop adaptation strategies, and effective water harvesting techniques to mitigate the effects of water deficit on crop growth. **CO4**: learn the principles and practices of watershed management, and efficient water utilization to enhance sustainability in rainfed areas.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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.						**CO1**
	Unit 2: (3 hours) • Soil and water conservation techniques, • Drought: types, effect of water deficit on physio- morphological characteristics of the plants, • Crop adaptation and mitigation to drought.						**CO2**
	Unit 3: (3 hours)						**CO3**

	• Water harvesting: importance, its techniques, efficient utilization of water through soil and crop management practices, • Management of crops in rainfed areas.	
	Unit 4: (3 hours) • Contingent crop planning for aberrant weather conditions, • Concept, objective, principles and components of watershed management, factors affecting watershed management.	**CO3**
	Practical: (24 hours) • Studies on climate classification, • Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. • Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. • Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo- transpiration demand of crops. • Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. • Characterization and delineation of model watershed. • Field demonstration on soil & moisture conservation measures. • Field demonstration on construction of water harvesting structures. • Visit to rainfed research station/watershed**.**	
Reference Books	1. Jayanthi, C. and Kalpana, R. 2016. Dryland Agriculture, Kalyani Publishers, Ludhiana. 2. Reddy, S.R. and Reddy, G. Prabhakara. 2015. Dryland Agriculture, Kalyani Publishers, Ludhiana. 3. Murthy, J. V. S. 1994. Watershed Management, Wiley Eastern Limited. New Age International Limited, New Delhi. 4. Dhruva Narayan, V.V. Singh, P.P., Bhardwaj, S.P., U. Sharma, Sikha, A.K., Vital, K.P.R. and Das, S.K. 1987. Watershed Management for Drought Mitigation, ICAR, New Delhi. 5. Singh, R.P., Sharma, S., Padmnabhan, N.V., Das, S.K. and Mishra, P.K. 1990.A Field Manual on Watershed Management, ICAR (CRIDA), Hyderabad	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 321**						
Course Title	**Protected Cultivation and Secondary Agriculture**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Greenhouse technology, greenhouse types and construction and material used. **CO2:** Making low-cost green house, irrigation systems used **CO3:** Concept of clearing and grading and moisture measurements.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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 equipment, materials of construction for traditional and low-cost greenhouses.						**CO1**
	Unit 2: (3 hours) • Irrigation systems used in greenhouses, typical applications, • Passive solar green house, hot air greenhouse heating systems, green house drying. • Cost estimation and economic analysis.						**CO2**
	Unit 3: (3 hours) • Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation.						**CO3**

	Unit 4: (3 hours) • 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.	**CO3**
	Practical: (24 hours) • 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 equipment. • 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.	
Reference Books	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 K u m a r 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.	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 322**						
Course Title	**Diseases of Field and Horticultural crops and their management-II**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: Identify and describe the symptoms, etiology, and disease cycles of major diseases affecting field and horticultural crops, **CO2**: Develop comprehensive management strategies for controlling diseases in diverse crops, applying integrated disease management practices tailored to specific pathogens and environmental conditions. **CO3**: Understand the relationship between environmental factors, plant physiology, and disease development, enabling the effective diagnosis and prevention of crop diseases. **CO4**: Gain practical skills in disease management, to minimize losses and enhance crop health and yield across a wide range of agricultural and horticultural crops.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** Symptoms, etiology, disease cycle and management of major diseases of following crops: • Field Crops: Wheat: rusts and smuts, powdery mildew, *Alternaria* blight, and ear cockle; • Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and pokkahboeng						**CO1**
	Unit 2: (6 hours) Symptoms, etiology, disease cycle and management of major diseases of following crops: • Sunflower: *Sclerotinia* stem rot and *Alternaria* blight;						**CO2**

	• Mustard: *Alternaria* blight, white rust, downy mildew and *Sclerotinia* stem rot; • Gram: wilt, grey mould and *Ascochyta* blight; • Lentil: rust and wilt, Pea: downy mildew, powdery mildew and rust.	
	Unit 3: (5 hours) Symptoms, etiology, disease cycle and management of major diseases of following crops: • 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.	**CO3**
	Unit 4: (7 hours) Symptoms, etiology, disease cycle and management of major diseases of following crops: • Strawberry: leaf spot, • Potato: early and late blight, potato virus X, potato virus Y, 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.	**CO3**
	Practical: (24 hours) • 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 323**						
Course Title	**Post-harvest Management and value addition of fruits and Vegetables**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** knowledge of present scenario of fruits and vegetables processing industries, **CO2:** importance and activities **CO3:** identify and provide inputs to mitigate post-harvest losses during cool chain management.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post-harvest losses; • Pre-harvest factors affecting postharvest quality, maturity standards, ripening and changes occurring during ripening, use of growth regulators for ripening.						**CO1**
	Unit 2: (3 hours) • Respiration and factors affecting respiration rate; • Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); • Value addition concept.						**CO2**
	Unit 3: (4 hours) • 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						**CO3**

	Unit 4: (2 hours) • Drying/ Dehydration of fruits and vegetables – Concept and methods, osmotic drying. • Canning -– Concepts and Standards, packaging of products.	**CO3**
	Practical: (24 hours) • 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.	
Reference Books	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	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 324**						
Course Title	**Management of beneficial insects**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** beneficial insects, commercial methods of their rearing, **CO2:** equipment's used in seasonal management of insect pest and diseases of beneficial insects **CO3:** mass production of pest controlling organisms and important *spp*. for commercial use to control harmful pests.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • 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						**CO1**
	Unit 2: (3 hours) • Types of silk worm, 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.						**CO2**
	Unit 3: (3 hours) • Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products.						**CO3**

	• Identification of major parasitoids and predators commonly being used in biological control.	
	Unit 4: (3 hours) • 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.	**CO3**
	Practical: (24 hours) • Honey bee species, castes of bees. • Beekeeping appliances and seasonal management, bee enemies and disease. • Bee pasturage, bee foraging and communication. • Types of silk worm, 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.	
Reference Books	1. De Bach, 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.	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 325**						
Course Title	**Crop improvement-II (*Rabi* crops)**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: Gain an understanding of the centre of origin, distribution, and wild relatives of various *Rabi* crops **CO2**: Develop knowledge of plant genetic resources, genetic of qualitative and quantitative traits and breeding objectives for crop improvement **CO3**: Learn improving *Rabi* crops, using both conventional and modern breeding techniques **CO4**: Master hybrid seed production technologies for Rabi crops and explore the ideotype concept and development of climate-resilient crop varieties						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (4 hours)** • Centres of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops • Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters.						**CO1**
	Unit 2: (2 hours) • Major breeding objectives for the improvement of *Rabi* crops						**CO2**
	Unit 3: (3 hours) • Breeding 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).						**CO3**
	Unit 4: (3 hours) • Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future.						**CO3**

	Practical: (24 hours) • 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	
Reference Books	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, 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. 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	

In Hours			
L	T	P	Credits
0	1	4	2

Course Code	**AGS 326**						
Course Title	**Practical Crop Production-II (*Rabi* crops)**						
Hours	48 L:0, T:1, P:4						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Crop production, planning and management of *Rabi* crops, **CO2:** Seed production, mechanization resource conservation **CO3:** Working economics of production **CO4:** INM and IPM technologies in *Rabi* crops.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (12 hours)** • Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting,						**CO1**
	Unit 2: (12 hours) • Threshing, drying winnowing, storage and marketing of produce. Seed production, mechanization, resource conservation						**CO2**
	Unit 3: (12 hours) • Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.						**CO3**
	Unit 4: (12 hours) • Integrated nutrient, insect-pest and disease management technologies.						**CO4**
Reference Books	1. Yawalkar, K.S., Agarwal, J.P. and Bokde, S. 2008. Manures and Fertilizers (10th edition). Agri-Horticultural Publishing House, Nagpur. 2. Balasubramaniyan, P. and Palaniappan, S.P. 2016. Principles and Practices of Agronomy (2nd edition). Agrobios (India),						

	Jodhpur. 3. Reddy, S. R. 2016. Principles of Agronomy (5th edition). Kalyani Publishers, Ludhiana. 4. Singh, S.S. and Singh, Rajesh. 2015. Principles and Practices of Agronomy (5th Re-set). Kalyani Publishers, New Delhi,	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 327**						
Course Title	**Principles of organic farming**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Basic concepts of organic farming, **CO2:** Various organic components **CO3:** To control diseases and pests through organic inputs **CO4:** Certification of organic produce, their marketing and export						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (2 hours)** • Organic farming, principles and its scope in India; • Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture.						**CO1**
	Unit 2: (4 hours) • 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.						**CO2**
	Unit 3: (3 hours) • Fundamentals of insect, pest, disease and weed management under organic mode of production; • Operational structure of NPOP.						**CO3**
	Unit 4: (3 hours) • Certification process and standards of organic farming; • Processing, levelling, economic considerations and viability, • Marketing and export potential of organic products						**CO4**

	Practical (24 hours) • 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.	
Reference Books	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	

In Hours			
L	T	P	Credits
1	0	2	2

Course Code	**AGS 328**						
Course Title	**Farm management, production and resource economics**						
Hours	36 L:1, T:0, P:2						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Importance of natural resources for agriculture production **CO2:** Conservation of natural resources, land utilization pattern, different type of farming systems **CO3:** Cost calculation of agriculture produce, maintenance of farm record, farm efficiency, farm budget process **CO4:** Collection and analysis of data on various resources in India and risk in farming business						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (4 hours)** • Meaning and concept of farm management, objectives and relationship with other sciences. • Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. • Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage.						**CO1**
	Unit 2: (4 hours) • 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						**CO2**

	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.	
	Unit 3: (4 hours) • 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.	**CO3**
	Unit 4: (4 hours) • 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.	**CO4**
	Practical (24 hours) • Preparation of farm layout. • Determination of cost of fencing of a farm. • Computation of depreciation cost of farm assets. • Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. • Determination of most profitable level of inputs use in a farm production process. • 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.	
Reference Books	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.	

In Hours			
L	T	P	Credits
2	0	0	2

Course Code	**AGS 329**						
Course Title	**Principles of food science and nutrition**						
Hours	24 L: 2, T: 0, P: 0						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** food composition and chemistry, **CO2:** food microbiology, principles and methods of food processing and preservation **CO3:** nutrition and nutritional disorders **CO4:** design food products that comply with various food regulation and laws.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**10%**	**25%**	**0**	**50%**	**0**	**5%**
Examination Mode	Theory						
Syllabus	**Unit 1: (6 hours)** Concepts of Food Science: definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.						**CO1**
	Unit 2: (6 hours) Food composition and chemistry: water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bio-actives, important reactions.						**CO2**
	Unit 3: (6 hours) 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.).						**CO3**
	Unit 4: (6 hours) 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.						**CO4**

Reference Books	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, NewDelhi. 5. Swaminathan. M. 1993. Advanced Textbook on Food and Nutrition. Volume I, Bappco, the Bangalore Press and Publishing Co. Ltd. Bangalore.	

Elective Courses

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS330A**						
Course Title	**Hi-tech Horticulture**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** To learn the basic concepts about protected structures **CO2:** Ventilation and temperature management in protected structures **CO3:** Fertigation management in protected structures **CO4:** To understand the preparation and selection of various materials for protected structures						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • Principles of constructing various protected structures • Greenhouse effect • Components of green house and detailed specification • Basic concepts to construct various protected structures i.e. Automated Green House, Poly houses, Poly tunnels, Shade net house and Trenches						**CO1**
	Unit 2: (6 hours) • Cooling and heating system • Ventilation system and humidity management in green house • Arrangement of pots, benches, protrays etc						**CO2**
	Unit 3: (6 hours) • Irrigation systems and fertigation management for protected cultivation						**CO3**

	• Preparation of artificial growing media and its sterilization for protected cultivation	
	Unit 4: (6 hours) • Arrangement and preparation of growing beds for various protected structures • Selection of various cladding materials for protected structures	
	Practical (24 hours) • Identification and application of various cladding materials for protected structures. • Construction and management of low-cost poly houses. • Installment and maintenance of cooling and heating system under greenhouse. • Cost estimation of automated green house. • Construction and cost estimation of poly house and tunnels. • Care and maintenance of irrigation and fertigation system under polyhouse.	
Reference Books	1. Anonymous, 2011. Technical standards for naturally ventilated, fan green house and shade net house, NHB, Gurgaon- Haryana (E- Book). 2. http://www.fao.org/3/a-i3284e.pdf (E- Book) 3. http://horticulture.ap.nic.in/Section%20wise/MIDH/Documents/P_C_G LINES.pdf (E- Book). 4. http://rvskvv.net/images/New-Age-Protected-Cultivation_20.04.2020. (E- Book) 5. https://www.researchgate.net/publication/267342460_Micrometeoro _Principles_of_Protected_Cultivation. (Article) 6. https://www.researchgate.net/publication/330039167_PROTECTED_C ATION_OF_ORNAMENTALS (Article).	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 330B**						
Course Title	**Weed Management**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will be able to identify various type of weeds and their classification **CO2:** Students will gain practical knowledge in the use of herbicide **CO3:** Students will explore the use of bioherbicide as an alternative of chemical herbicides and how to apply them **CO4:** Student will learn the mechanism of herbicide resistance and ensuring long term effectiveness						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. • Classification, reproduction and dissemination of weeds.						**CO1**
	Unit 2: (6 hours) • 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.						**CO2**
	Unit 3: (6 hours) • Bio-herbicides and their application in agriculture. • Concept of herbicide mixture and utility in agriculture. • Herbicide compatibility with agro-chemicals and their application						**CO3**

	Unit 4: (6 hours) • Integration of herbicides with non-chemical methods of weed management. • Herbicide resistance and its management.	**CO4**
	Practical (24 hours) • 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 equipment. • Calculations of herbicide doses and weed control efficiency and weed index	
Reference Books	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.	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 330C**						
Course Title	**System Simulation and Agroadvisory**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students understand and apply crop growth model **CO2:** Students will learn the manage crop production under moisture deficit **CO3:** Students will be able to interpret weather forecast and use crop weather calendar **CO4:** Students will learn to apply crop stimulation for agro advisory						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • 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;						**CO1**
	Unit 2: (6 hours) • Elementary crop growth models; calibration, validation, verification and sensitivity analysis. • Potential and achievable crop production- concept and modelling techniques for their estimation.						**CO2**
	Unit 3: (6 hours) • 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;						**CO3**

	Unit 4: (6 hours) • 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.	**CO4**
	Practical (24 hours) • 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 agroadvisory	
Reference Books	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	

In Hours			
L	T	P	Credits
2	0	2	3

Course Code	**AGS 330D**						
Course Title	**Agricultural Journalism**						
Hours	48 L:2, T:0, P:2						
Credits	3						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students Understanding the scope of agricultural journalism. **CO2:** Students will learn the exploring newspapers and magazines in agricultural communication. **CO3:** Students will be able to crafting engaging agricultural stories. **CO4:** Students will learn to analyzing the influence of media on agriculture						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**10%**	**0**	**25%**	**0**	**35%**	**25%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (6 hours)** • Agricultural Journalism: The nature and scope of agricultural journalism • Characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.						**CO1**
	Unit 2: (6 hours) • 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.						**CO2**
	Unit 3: (6 hours)						**CO3**

	• 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 4: (6 hours) • 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.	**CO4**
	Practical (24 hours) • Practice in interviewing. • Covering agricultural events. • Abstracting stories from research and scientific materials and from wire services. • Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. • Practice in editing, copy reading, headline and title writing, proofreading, layouting. • Testing copy with a readability formula. Visit to a publishing office.	
Reference Books	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 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	

In Hours			
L	T	P	Credits
1	0	4	3

Course Code	**AGS 330E**						
Course Title	**Commercial Protected Cultivation**						
Hours	60 L:1, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Study about commercial nursery raising and seed production **CO2:** Study about cultivation of hi-tech horticultural crops **CO3:** Hydroponics, aeroponics and **CO4:** Post-harvest management						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (4 hours)** • Commercial nursery raising and transplanting of horticultural crops and techniques of seed production.						**CO1**
	Unit 2: (4 hours) • Hi-tech cultivation of horticultural crops and their management (Tomato, capsicum, cucumber, parsley, broccoli, chinese cabbage, lettuce, melons, strawberry, roses, chrysanthemum, carnation, gerbera, and orchids).						**CO2**
	Unit 3: (4 hours) • Commercial production of hydroponics and aeroponics; constraints and solution.						**CO3**
	Unit4: (4 hours) • Post-harvest management of horticultural produce.						**CO4**
	Practical: (48 hours) • Nursery management of horticultural crops • Propagation techniques, lifting and packaging of nursery plants. • Preparation of media and mixtures, and raising nursery in poly bags. • Intercultural operations in horticultural crops under protected condition.						

	• Seed production techniques of important vegetable and flower crops under protected condition. • Irrigation and fertigation under protected condition. • Integrated insect-pest and disease management of commercially important horticultural crops. • Raising hydroponics and aeroponics under protected cultivation. • Post-harvest handling and marketing of commercially important horticultural crops. • Visit to hi-tech green-/ polyhouses.	
Reference Books	1. Warade, S. D. 2003. Protected cultivation of Horticulture crops. MPKV, Rahuri. 2. Singh, B. 2005. Protected cultivation of vegetable crops. Kalyani publishers, New Delhi. 3. Prasad, S. and Kumar, U. 2003. Commercial Floriculture, Agrobios India. 4. Patil, M.T and Patil, P.V. 2004. Commercial Protected Floriculture, MPKV, Rahuri. 5. Singh, B. 2020. New Age Protected Cultivation, Bramha Sungh Horticulture Foundation, form New Delhi. **6.** Tiwari, G.N. 2003. Green House Technology for Controlled Environment, Narosa Publication House	

In Hours			
L	T	P	Credits
1	0	4	3

Course Code	**AGS 330F**						
Course Title	**Commercial Beekeeping**						
Hours	60 L:1, T:0, P:2						
Credits	3						
Type	**Departmental Elective**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Establishment of apiary and handling of bees **CO2:** Honeybee nutrition and rearing **CO3:** Protection of honey bees **CO4:** Economics of honey production						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Apiary site selection; • Establishment of beehive; • Handling of bee colonies. • Migration of bees, factors affecting migration of bees.						**CO1**
	Unit 2: (3 hours) • Honeybee nutrition. • Bee pheromones. • Artificial queen bee rearing techniques. • Communication in bees.						**CO2**
	Unit 3: (3 hours) • Protection from pesticidal hazards. • Maximizing honey production.						**CO3**
	Unit 4: (3 hours) • Economics of beekeeping						
	Practical: (48 hours) • Step by step learning for starting beekeeping. • Calendar of availability and utility of flora for the bees.						

	• Colony examination, feeding, shifting /migration of colonies, multiplication and mass queen bee rearing techniques. Collection and post-harvest handling of honey: Honey heating, processing, packaging, storage, quality testing. • Collection, processing and storage of royal jelly, pollen, propolis, bee venom, beeswax and bee brood. • Production of comb foundation sheets. • Acquaintance with the various components of Honey Processing Plant and their working. • Acquaintance with bottle washing, drying, packing and bottle sealing units for commercial beekeeping. • Visits to the beekeeping industry to study hive manufacturing, bee equipment manufacturing, honey processing, packaging, and its commercial export.	
Reference Books	1. Sammataro, D. and Avitabile, A. (2011) The Beekeepers' Handbook. Cornell University Press, Ithaca, London. 2. Singh, S. (1975) Bee keeping in India – ICAR, New Delhi., 214p. 3. Sunita, N.D, Guled, M.B, Mulla, S.R and Jagginavar (2003) Beekeeping. UAS Dharwad 4. Mishra, R.C. and Rajesh G (2002). Prospective in Indian Apiculture. Agrobios, Jodhpur. 5. Singh, D. and Singh, D.P. 2006. A Hand Book of Beekeeping, Agrobios (India). 98 6. Paul De Bach and Devid Rosen 1991. Biological control by natural enemies. Cambridge University Press; 2 ed	

In Hours			
L	T	P	Credits
1	0	4	3

Course Code	**AGS 330G**						
Course Title	**Commercial Mushroom Cultivation**						
Hours	60 L:1, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Spawn production **CO2:** Compost, casing, substrate production and spawning **CO3:** Harvesting and storage, processing of mushroom **CO4:** Mushroom pest and pathology and their management						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Preparation of culture, mother spawn production, multiplication of spawn, cultivation techniques						**CO1**
	Unit 2: (3 hours) • Basic requirement of cultivation of edible white button and oyster mushroom. • Preparation of compost, casing and crop care, substrate selection, substrate soaking, pasteurization, bagging, spawning, Incubation						**CO2**
	Unit 3: (3 hours) • Harvesting, packing and storage, processing of mushroom						**CO3**
	Unit 4: (3 hours) • Mushroom pest and pathology and their management strategies,						**CO4**
	Practical: (48 hours) • Preparation of media for mushroom culture. • Preparation and maintenance of pure culture of mushroom. Spawn preparation. • Long and short method of composting.						

	• Cultivation of mushroom: Bagging, spawning, casing, growing, harvesting of mushrooms, post-harvest practices of mushroom.	
Reference Books	1. Ravindra Singh Rana. 2020. Mushroom Cultivation and its Diseases, Daya Books, New Dehli. 2. R. Gogoi and Y. Rathaiah. 2006. Mushroom Cultivation Technology, Scientific Publishers, New Delhi 3. B. C. Suman and V.P. Sharma. 2007. Mushroom cultivation in India, Daya Books, New Delhi 4. V. P. Sharma. 2011. Diseases and pest of mushrooms, Agribios, India.	

In Hours			
L	T	P	Credits
1	0	4	3

Course Code	**AGS 330H**						
Course Title	**Commercial Non-conventional Farming**						
Hours	60 L:1, T:0, P:2						
Credits	3						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Concepts of organic farming **CO2:** Nutrient management and intercropping **CO3:** Construction of green houses, constraints and solutions **CO4:** Management of pests and diseases; marketability						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**10%**	**0**	**0**	**20%**	**35%**	**30%**	**5%**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (3 hours)** • Organic farming: Commercial importance; pre-requisites for starting organic farming at commercial level; crop-wise methods and practices; constraints in organic farming and solution.						**CO1**
	Unit 2: (3 hours) • Biological intensive nutrient management; techniques of recycling of organic residue to sustain soil fertility. • Intercropping for maintenance of good soil health.						**CO2**
	Unit 3: (3 hours) • High tech protected cultivation: Feasibility of raising crops for commercial purpose under green-/ polyhouses; constraints and solution.						**CO3**
	Unit 4: (3 hours) • Management of pests and diseases and marketability of the produce						
	Practical: (48 hours) • Raising crops as per the concept of organic farming utilizing various techniques methods.						

	• Method demonstrations for intensive nutrient management to conserve soil fertility. • Hi-tech cultivation of crops in green-/polyhouses and marketability of the produce. • Visits to the fields of progressive farmers involved in non-conventional farming	
Reference Books	1. Biswas, R. K. (2014) Organic Farming in India, ND Publishers, New Delhi 2. Walia S S (2021) Organic Crop production. Scientific publishers Jodhpur 3. Yawalkar KS, JP Agarwal and S Bokde (2016) Manures and Fertilizers, Agri-horticutural Publishing house, Nagpur 4. Singh Brahma (2015) Advances in protected cultivation. New India Publishing Agency, New Delhi	

Semester 7

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS-412**						
Course Title	General orientation & On campus training by different faculties Village attachment Unit attachment in Univ./ College. KVK/ Research Station Attachment						
Hours	240 L:0, T:0, P:20						
Credits	10						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Survey of Village and agronomical interventions **CO2:** Plant Protection and soil improvement interventions **CO3:** Fruit and Vegetable production, Food Processing and Storage **CO4:** Animal Production, Extension and Transfer of Technology activities						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** **Survey of Village and agronomical interventions** • General orientation & On campus training by different faculties • Socio-economic survey of households nearby university campus (adopted villages) • Unit attachment in University/ College. KVK/ Research Station Attachment • Agronomical interventions (Package of practices of field crops)						**CO1**
	Unit 2: (60 hours) **Plant Protection and soil improvement interventions** • Plant protection of crops (cereals, vegetables, fruits and flowers etc.) **Soil Improvement Interventions** • Soil sampling • Soil testing (Analysis of macro and micro nutrients)						**CO2**

	• Leaf analysis (Analysis of macro and micro nutrient content)	
	Unit 3: (60 hours) **Fruit and Vegetable production, Food Processing and Storage** • Production of different fruits and vegetable crops • Cultural operation in fruits and vegetable crops • Harvesting • Food processing • Storage, packaging, Grading, Transportation and Marketing etc.	**CO3**
	Unit 4: (60 hours) **Animal Production,** • Rearing of cattle, buffalo, goat **Extension and Transfer of Technology activities** • Adoption of different Govt. Schemes and their impact analysis • Latest technology involved in agriculture such as protected farming, precision farming	**CO4**
Reference Books:	• Handbook of Agricultural extension by Indian Council of Agricultural Research. • Agricultural economics and extension by R Parmialaranjan, M Kalpana and N Suganthi. • Principles and Procedures of Plant Protection by BS Chattopadhyay. • Farmers Guide to Profitable Dairy Farming by PA Reshi. • Sustainable Agriculture: Advances in Technological interventions by Ajay Kumar Singh and Vijay Bandhu Patel. • Soil Health Improvement Through Biofertilizers by Dr. Sudhir Pradh	

In Hours			
L	T	P	Credits
0	0	4	2

Course Code	**AGS 413**						
Course Title	**Plant Clinic**						
Hours	48 L:0, T:0, P:4						
Credits	2						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Soil sampling and testing, identify nutrient deficiency under field conditions and able to suggest corrective measures **CO2:** Identification and management practices of different diseases **CO3:** Identification and management practices of different pests **CO4:** Seed testing and seed treatment, identification and management of seed borne pest & diseases						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • Importance of plant diseases, scope and objectives of Plant diseases • History of Plant Pathology with special reference to Indian work • Terms and concepts in Plant diseaeses						**CO1**
	Unit 2: (60 hours) • Cause and classification of plant diseases						**CO2**
	Unit 3: (60 hours) • 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						**CO3**
	Unit 4: (60 hours) • Diseaeses of field, vegetables and fruit crops and their management.						**CO4**

Reference Books	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. 5. Sen, Subir and Ghosh, Nabinanda. 2015. Seed Science and Technology. Kalyani Publishers. New Delhi.	

In Hours			
L	T	P	Credits
0	0	8	4

Course Code	**AGS 414**						
Course Title	**Agro-Industrial Attachment**						
Hours	96 L:0, T:0, P:8						
Credits	4						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Learning business network including outlets of the industry **CO2:** Skill development in all crucial tasks of the industry **CO3:** Documentation of the activities and task performed **CO4:** Performance evaluation						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (6 hours)** **Students shall be placed in Agro-and Cottage industries and Commodities Boards** • Learning business network including outlets of the industry • Industries include Seed/Sapling production, Pesticides-insecticides, Post-harvest processing-value addition, Agri-finance institutions, etc.						**CO1**
	Unit 2: (6 hours) **Skill development in all crucial tasks of the industry** • Study of structure, functioning, objective and mandates of the industry						**CO2**
	Unit 3: (6 hours) **Documentation of the activities and task performed** • Study of various processing units and hands-on trainings under supervision of industry staff • Ethics of industry						**CO3**
	Unit 4: (6 hours) **Performance evaluation** • Employment generated by the industry • Contribution of the industry promoting environment						**CO4**

Reference Books	1. Agricultural economics and extension by R Parmialaranjan, M Kalpana and N Suganthi. 2. Economics of Farm Management by: A Global Prospective by Kent Olsen and John Wastra. 3. Agricultural Finance by Subba Reddy and Raghu Ram. 4. Post-harvest Management and Processing of Fruits and Vegetables by NS Rathore, GK Mathur and SS Chasta	

Semester 8

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411A**						
Course Title	**Production Technology for Bioagents and Biofertilizers**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** to isolate and establish pure cultures of biofertilizers and biopesticides **CO2:** to evaluate the bioefficacy of different biocontrol agents and biofertilizers against plant pathogens and pests, and apply methods for the mass production **CO3:** in preparing growth media for biofertilizers and applying them effectively in agricultural practices **CO4:** of quality control and evaluate the cost analysis and commercialization aspects in the production of biofertilizers, biopesticides for sustainable agricultural practices.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • 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*, *Crysoperla.* • Mass multiplication of *Trichoderma*/ *Pseudomonas*/ *Bacillus*. • Testing of quality parameters and standardization of biopesticides.						**CO1**

	• Commercialization of biocontrol agents. Screening and bioefficacy of different botanicals against plant pathogens.	
	Unit 2: (60 hours) • 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, *Azospirillium* 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.	**CO2**
	Unit 3: (60 hours) • Methods of application of *Trichoderma*/ *Pseudomonas*/ *Bacillus*/, *Trichogramma, Cryptolaemus, Crysoperla, Rhizobium, Azotobacter, Azospirillum* and phosphate solubilizing biofertilizers. • Methods of application of Azolla and blue green algal biofertilizers in paddy farming.	**CO3**
	Unit 4: (60 hours) • Quality control of biofertilizers-standards specified and estimating the viable bacterial countin 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.	**CO4**
Reference Books	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.	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411B**						
Course Title	**Seed Production and Technology**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** in understanding of the seed industry, including its importance, challenges, and role in modern agriculture. **CO2:** in the production of high-quality seeds for various crops, with a focus on seed harvesting techniques and post-harvest processing. **CO3:** to apply various seed treatments to improve seed germination, including chemical, biological, and physical treatments. **CO4:** to perform seed quality control tests, ensuring the purity, germination, and viability of seeds.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • Introduction, structure of Seed Industry in India; producing good quality seeds; • Factors Influencing Seed Production; • Maintenance of Pure Accessions; • Post-harvest processing & certification						**CO1**
	Unit 2: (60 hours) • 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)						**CO2**
	Unit 3: (60 hours)						**CO3**

	• 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 4: (60 hours) • 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.	**CO4**
Reference Books	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 3. Sen, Subir and Ghosh, Nabinanda.2015. Seed Science and Technology. Kalyani Publishers. New Delhi. 4. Pooran M Gaur, Shailesh Tripathi, CL Laxmipathi Gowda, GV Ranga Rao, HC Sharma, Suresh Pande and Mamta Sharma, 2010. Chickpea seed production manual. ICRISAT, Patancheru 502 324 Andhra Pradesh, India	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411C**						
Course Title	**Mushroom Cultivation Technology**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will be able to design and construct appropriate cultivation rooms/structures for mushroom farming, ensuring the ideal environmental conditions for optimal growth **CO2:** Students will develop practical skills in preparing compost and pasteurizing it for mushroom cultivation. **CO3:** Students will gain hands-on experience in mushroom seeding, preparation of casing soil and maintaining the ideal growing conditions **CO4:** Students will acquire knowledge in harvesting, grading, and processing mushrooms. They will also learn about packaging and marketing strategies for commercial mushroom farming.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • Construction cultivation room/structure and Disinfection.						**CO1**
	Unit 2: (60 hours) • Compost preparation & amp; pasteurization. Procurement of mother culture and spawn preparation.						**CO2**
	Unit 3: (60 hours) • Procurement of casing soil and preparation for production. Mushroom seeding, Casing with soil and maintenance						**CO3**
	Unit 4: (60 hours)						**CO4**

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

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411D**						
Course Title	**Commercial Beekeeping**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will gain a comprehensive understanding of the scope and importance of beekeeping, including the classification of bees, the structure of hives, and the social organization within a bee colony **CO2:** Students will develop Practical Skills in Bee Flora Management and Hive Establishment **CO3:** Students will learn Management of Beekeeping Appliances, Bee Health, and Seasonal Practices **CO4:** Students will learn how to harvest and process honey and beeswax, and understand the steps involved in marketing these products.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • Apiculture-Scope and importance of beekeeping • Bees classification • Hives • Social organization • Extraction of honey and other products. • Procurement and arrangement of bee keeping equipment. • Location and collection of potent nectar yielding bee flora seeds from wild. • Raising/ enriching the high nectar yielding bee flora in the campus.						**CO1**
	Unit 2: (60 hours)						**CO2**

	• Location and hiving the natural bee colony from the wild. • Establishing the apiary with suitable/favourable necessaries. • Maintenance and multiplication of hived colonies. • Visit to research and training institutions devoted to beekeeping.	
	Unit 3: (60 hours) • Beekeeping appliances and seasonal management, • Bee enemies and disease. • Bee pasturage, bee foraging and communication. • Management of natural enemies and diseases of bees.	**CO3**
	Unit 4: (60 hours) • 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	**CO4**
Reference Books	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. Singh, D and Singh, D.P. 2006. A hand book of Beekeeping, Agrobios (India). 4. Mishra, R.C. and Rajesh Gar. 2002. Prospective in Indian Apiculture. Agrobios, Jodhpur. 5. Sunita, N.D, Guled , M.B, Mulla S. R. and Jagginavar. 2003. Beekeeping, UAS Dharwad	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411E**						
Course Title	**Agriculture Waste management**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** in the understanding of the nature and characteristics of agricultural waste, including its environmental impact **CO2:** to learn the principles of composting, including the methods of composting and vermicomposting **CO3:** to explore the potential of agro residues for biomass briquetting, including the characteristics of suitable materials and the technologies involved. **CO4:** of biogas and bio-ethanol production from agricultural waste						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (60 hours)** • 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.						**CO1**
	Unit 2: (40 hours) • Composting: Definition- Solid waste suitable for composting, • Methods of composting, • Mineralization process in composting, • Biochemistry of composting,						**CO2**

	• Factors involved, Infrastructure required, maturity parameters, value addition and application methods.	
	Unit 3: (80 hours) • 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. • Biogas and Bio-ethanol Production: Screening of suitable lingo 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 lingo cellulosic wastes, processing of biomass to ethanol.	**CO3**
	Unit 4: (60 hours) • 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 livestock, dairy, poultry, food processing, fruit & vegetable and agri-chemicals.	**CO4**
Reference Books	1. Fageria, N. K. and Figueiredo, A. B. 2009. Composting for Sustainable Agriculture. Springer 2. Lal, Rattan and Stewart, B. A. 2014. Sustainable Agriculture and Food Security. CRC Press 3. Rakshit, Amitava. 2015. Sustainable Agriculture and Waste Management**.** Springer 4. Hegde, B. K. 2007. Agricultural Waste Management: Principles and Practices. New India Publishing Agency 5. Kamprath, E. J. 1995. Soil and Plant Analysis for Agricultural Systems. CRC Press 6. Dwivedi, B. S. 2014. Soil and Plant Analysis in Sustainable Agriculture. Springer	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411F**						
Course Title	**Floriculture and Landscaping**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will learn how to plan and lay out a commercial flower garden, including the production and management of various flowers **CO2:** Students will acquire skills in planning and designing landscapes, including performing site analysis and selecting appropriate plant materials. **CO3:** Students will gain the ability to prepare landscape plans for diverse environments **CO4:** Students will develop practical skills in flower arranging, Dry Flower Technology, and Value Addition						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (60 hours)** • 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.						**CO1**
	Unit 2: (60 hours) • Planning and designing, site analysis, selection and use of plant material for landscaping. • Formal and informal garden, features, styles, principles and elements of landscaping.						**CO2**
	Unit 3: (60 hours)						**CO3**

	• Preparation of landscape plans of home gardens, farm complexes, public parks, institutions, high ways, dams and avenues. • Making of lawns.	
	Unit 4: (60 hours) • Making of bouquets, button hole, wreath, veni and gazaras. • Dry flower Technology (identification of suitable species, drying, packaging and forwarding techniques).	**CO4**
Reference Books	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	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	AGS 411G						
Course Title	**Commercial Horticulture**						
Hours	240 L: 0, T: 0, P: 20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** in the nursery production of fruit crops, including the raising of rootstocks, grafting, and budding techniques. **CO2:** to produce plantlets and potted plants in a nursery setting. **CO3:** involved in protected cultivation, including nursery raising, procurement, transplanting, and managing vegetable and flower crops under controlled environments. **CO4:** of modern technologies in protected cultivation, including the use of plastic mulch in polyhouses, drip irrigation, fertigation, and staking and training of high-value crops.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (60 hours)** • Nursery production of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants, plant certification, packaging and marketing, quality control.						**CO1**
	Unit 2: (60 hours) • Nursery production of ornamentals: Production of plantlets, production of potted plants, management and maintenance, sale and marketing.						**CO2**
	Unit 3: (60 hours) • Protected cultivation of vegetables and flowers: Nursery raising/procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing.						**CO3**

	Unit 4: (60 hours) • Role of plastic mulch in polyhouse, transplanting of high value crops, drip irrigation and fertigation, staking and training, plant protection under protected environment.	**CO4**
Reference Books	1. Dhaliwal M.S. 2008. Handbook of vegetable crops, Kalyani Publishers, Ludhiana, 2008. 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. Bhattacharjee, Supriya, 2007. Ornamental crop production technology. Pointer Publishers. Jaipur. 4. Randhawa, Gurcharan Singh and Mukhopadhyaya, Amitabha, 2001. Floriculture in India. Allied Publishers. 5. Adams, C. R. and Early, M. P. 2004. Principles of horticulture. Butterworth – Heinemam, Oxford University Press. 6. Chadha, K.L. 2001. Handbook of Horticulture. ICAR, New Delhi. 7. Bose, T. K. and Mitra, S. K. 2001. Fruits: Tropical and Subtropical. Naya Prokash; 3rd revised edition. 8. Anonymous. 2018. Package of Practices for Fruit Crops, P.A.U. Publications Ludhiana. 9. Bal J. S. 2007. Fruit Growing. Kalyani Publishers	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411L**						
Course Title	**Food processing**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will gain an understanding of the equipment used in food processing units, including the tools and machinery used for the processing of fruits and vegetables. **CO2:** Students will learn the canning process for fruits and vegetables, including the principles of preservation, sterilization, and packaging **CO3:** Students will develop the skills to prepare a variety of value-added food products **CO4:** Students will gain practical experience in advanced preservation methods such as dehydration, refrigeration, and freezing of fruits and vegetables.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (60 hours)** • Equipment used in food processing units. • Physico-chemical analysis of fruits and vegetables. • Canning of fruits and vegetables.						**CO1**
	Unit 2: (60 hours) • Preparation of nectar, squash, cordial, syrup, jam, jelly and marmalade.						**CO2**
	Unit 3: (80 hours) • Preparation of candies, preserves, chutneys, sauces, pickles (hot and sweet).						**CO3**
	Unit 4: (80 hours) • Dehydration of fruits and vegetables, refrigeration and freezing, cut out analysis of processed foods.						**CO4**
Reference Books	1. Lal, Girdhari, Siddappa, G.S. and Tandon, G. L. 1959.						

	Preservation of Fruits and Vegetables. ICAR, New Delhi. 2. James, G. Brennan. 2006. Food Processing Handbook. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany. 3. Fellows, P. 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.	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411J**						
Course Title	**Organic Production Technology**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will be understanding of organic farming and also explore biological intensive nutrient management techniques **CO2:** Students will learn about integrated disease and pest management strategies in organic farming, including the use of biocontrol agents, bio-pesticides, pheromones, and trap crops. **CO3:** Students will acquire practical knowledge in the preparation of Composting, Vermicomposting, and Use of Biofertilizers **CO4:** Students will gain hands-on experience in raising vegetable and medicinal crops organically, focusing on nutrient, disease, and pest management strategies						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • Define organic farming, importance and scope of organic farming, • Feasibility of adoption 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.						**CO1**
	Unit 2: (60 hours)						**CO2**

	• 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 3: (60 hours) • 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, Phosphate solubilizing mycorrhiza.	**CO3**
	Unit 4: (80 hours) • Vegetable and medicinal crops nursery raising. • Raising of vegetable crops organically through nutrient, diseases and pest management; • macro quality analysis, grading, packaging, post-harvest management	**CO4**
Reference Books	1. Lockeretz, William. 2007. Organic Farming: An International History. CABI Publishing 2. Paul M. Grossman. 2011. Introduction to Organic Farming. Wiley-Blackwell 3. Ann Larkin Hansen. 2011. The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm. Storey Publishing 4. Hargreaves, C. M. 2011. Organic Farming: A Beginner's Guide to Growing Crops Naturally. Scribe Publications 5. John Havlin, Samuel Tisdale, Werner Nelson. 2013. Soil Fertility and Fertilizers: An Introduction to Nutrient Management. Pearson Education. (8th edition) 6. O'Connell, R. G. F. G. and O'Connor, P. J. P. C. 2010. Organic Crop Production: A Systems Approach. Springer	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	**AGS 411K**						
Course Title	**Commercial Sericulture**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will learn how to establish and maintain mulberry gardens, focusing on mulberry cultivation practices **CO2:** Students will gain knowledge of the different silkworm species, their systematic positions, and rearing techniques. **CO3:** Students will become proficient in using sericulture equipment and understanding essential practices such as disinfection, incubation, brushing, leaf preservation, and bed cleaning. **CO4:** Students will study various diseases, pests (including non-insect pests), and their management techniques,						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • Establishment of mulberry garden. • Mulberry cultivation, mulberry varieties • Preparation of mulberry cuttings, planting methods. • Maintenance of mulberry garden-pruning, fertilization, irrigation and methods of harvesting and preservation of leaves. • Mulberry pests and diseases and their management and nutritional disorders. • Herbarium preparation for host plants and weeds.						**CO1**
	Unit 2: (60 hours) • Establishment of mulberry garden.						**CO2**

	• Cultivation practices for different varieties of mulberry commencing from planting to harvesting. • Maintenance of mulberry garden-pruning, fertilization, irrigation and methods of harvesting and preservation of leaves. • 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 3: (80 hours) • 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 equipment 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 of silk glands. 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.	**CO3**
	Unit 4: (40 hours) • 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.	**CO4**
Reference Books	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, FAO Agriculture Services Bulletin.	

	Rome. 3. Tribhuwan Singh. Principles and Techniques of Silkworm Seed Production, Discovery publishing House Pvt. Ltd. 4. Narasaiah, M. L. 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.	

In Hours			
L	T	P	Credits
0	0	20	10

Course Code	AGS 411L						
Course Title	**Soil, Plant, Water and Seed Testing**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Type	**Elective Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Students will gain an understanding of various analytical instruments, their calibration, and their applications in soil nutrient analysis **CO2:** Students will learn the forms of nutrients in soil and the methods for analyzing plant tissue for nutrient content **CO3:** Students will develop the ability to analyze the quality of irrigation water **CO4:** Students will learn the principles and procedures for seed sampling, testing physical seed purity, and assessing seed health.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATT
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • 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 hydrolyzable 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.						**CO1**
	Unit 2: (60 hours) • Forms of nutrients in soil, Plant analysis, rapid plant tissue tests.						**CO2**

	• Estimation of Nitrogen in plants. • Estimation of Phosphorus in plants. • Estimation of Potassium in plants. • Estimation of Sulphur in plants.	
	Unit 3: (60 hours) • 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.	**CO3**
	Unit 4: (60 hours) • 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.	**CO4**
Reference Books	1. Tisdale, S. L. Nelson, W. L. Beaton, J. D. and Havlin, J. L. 1991. Soil fertility and fertilizers. Pretince 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 McGraw 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.	

In Hours			
L	T	P	Credits
0	0	20	20

Course Code	**AGS 424**						
Course Title	**Commercial Horticulture**						
Hours	240 L:0, T:0, P:20						
Credits	10						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Working knowledge of nursery management of fruits, vegetables and ornamental crops. **CO2:** Trained in grafting and budding **CO3:** Production of potted plants, protected cultivation of vegetables and flowers. **CO4:** Water, nutrient and disease management, post-harvest handling sale and marketing.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** **Nursery production of fruit crops:** grafting and budding of rootstocks, management of grafted plants, packaging and marketing, quality control. • Raising of rootstocks, **Nursery production of ornamentals and vegetable**s: • Production of plantlets						**CO1**
	Unit 2: (60 hours) • Grafting and budding of rootstocks and Management of grafted plants. • Plant certification. • Packaging and marketing and quality control.						**CO2**
	Unit 3: (60 hours) • Production of potted plants, management and maintenance, sale and marketing. • Protected cultivation of vegetables and flowers. • Procurement and transplanting, Management and maintenance of the crops.						**CO3**

	• Postharvest handling, quality control and marketing.	
	Unit 4: (60 hours) • Role of plastic mulch in polyhouse. • Drip irrigation and fertigation, staking and training. • Vegetable grafting. • Plant protection under protected environment.	**CO4**
Reference Books	1. Handbook of vegetable crops by M.S. Dhaliwal 2. Ornamental crop production technology by Supriya Bhattacharjee. 3. Fruits: Tropical and Subtropical by S. K. Mitra and T.K. Bose 4. Handbook of Horticulture by K.L. Chadha. 5. Spices and Condiments National Book Trust by Purthy, J.S. 6. Floriculture in India by G.S. Randhawa, and A. Mukhopadhyaya. 7. Principles of horticulture. Oxford University Press by C.R. Adams, and M. P. Early. 8. Fruit Growing by J. S. Bal.	

In Hours			
L	T	P	Credits
0	1	20	20

Course Code	**AGS 425**						
Course Title	**Commercial Beekeeping**						
Hours	240 L:0, T:1, P:20						
Credits	20						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Concept of bee keeping and identification of bee species of economic importance. **CO2:** Bee rearing implements and commercial and economic honey production. **CO3:** Seasonal management of bee enemies and diseases. Bee pasturage and foraging. **CO4:** Harvesting, processing, marketing and cost benefits analysis of bee products.						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (80 hours)** • Apiculture-Scope and importance of beekeeping • Bee classification • Hives, extraction and processing • Procurement and arrangement of bee keeping equipments • Location and collection of potent nectar yielding bee flora • Raising/ enriching the high nectar yielding bee flora in the campus.						**CO1**
	Unit 2: (80 hours) • Location and hiving the natural bee colony from the wild. • Establishing the apiary • Maintenance and multiplication of colonies. • Visit to research and training institutions.						**CO2**
	Unit 3: (80 hours) • Beekeeping appliances and seasonal management. • Bee enemies and disease. • Bee pasturage, bee foraging and communication. • Management of natural enemies and diseases of bees.						**CO3**

	Unit 4: (80 hours) • 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. • Benefit Cost analysis.	**CO4**
Reference Books	1. Beekeeping in India by S. Singh. 2. Honey bees and their management in India by R.C. Mishra. 3. Beekeeping: A Comprehensive Guide to Bee and Beekeeping by D.P. Abrol. 4. A hand book of Beekeeping by D. Singh and D.P. Singh. 5. Prospective in Indian Apiculture by R.C. Mishra and Gar Rajesh.	

In Hours			
L	T	P	Credits
0	1	20	10

Course Code	**AGS 426**						
Course Title	**Mushroom Cultivation Technology**						
Hours	240 L:0, T:1, P:20						
Credits	10						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Construction cultivation room/structure and Disinfection. **CO2:** Compost preparation & pasteurization **CO3:** Procurement of casing soil and preparation for production **CO4:** Post-harvest Management						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • Construction cultivation room/structure and Disinfection.						**CO1**
	Unit 2: (60 hours) • Compost preparation & pasteurization • Procurement of mother culture • Spawn Preperation						**CO2**
	Unit 3: (60 hours) • Procurement of casing soil and preparation for production • Mushroom seeding. • Casing with soil and maintenance						**CO3**
	Unit 4: (60 hours) • Harvesting and processing • Grading and packing • Marketing and Cost economics of mushroom culture						**CO4**
References Books	1. Mushroom Cultivation in India by BC Suman and VP Sharma. 2. A Handbook of Mushroom Cultivation by RK Pandey and SK Ghosh.						

In Hours			
L	T	P	Credits
0	1	20	10

Course Code	**AGS-427**						
Course Title	**Organic Production Technology**						
Hours	240 L:0, T:1, P:20						
Credits	10						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1:** Organic Farming **CO2:** Integrated Disease and Pest Management **CO3:** Preparation of organic manures **CO4:** Post-harvest Management of Organic Produce						
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ABL/PBL
Weightage	**0**	**20%**	**0**	**30%**	**0**	**50%**	**0**
Examination Mode	Practical						
Syllabus	**Unit 1: (60 hours)** • Definition of Organic farming, 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.						**CO1**
	Unit 2: (60 hours) • Use of biocontrol agents, bio pesticides pheromones, trap crops, bird perches • Weed management; quality considerations, • Certification, labeling and accreditation processors, marketing, exports.						**CO2**
	Unit 3: (60 hours) • 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.						**CO3**

	Unit 4: (60 hours) • Post-harvest management, Packaging and Grading • Raising of vegetable crops organically macro quality analysis • Vegetable and medicinal crops nursery raising.	**CO4**
References Books	1. Organic Farming in India. RK Biswas. 2. Organic Crop production. SS Walia. 3. Manures and Fertilizers, Agri-horticutural By KS Yawalkar, JP Agarwal and S Bokde. 4. Advances in protected cultivation by Brahma Singh	