



College of Agriculture

College of Agriculture
Dean: Prof. Sucheta Khokhar

B. Sc. (Hons.) Agriculture, 4-Year Programme
Courses: Semester-wise

Course No.	Course Title	Credits
Semester I		
AGM 101	Principles of Agricultural Meteorology	3 (2+1)
AGRON 101	Introductory Agriculture	1 (1+0)
COMP 101	Introduction to Computer Applications	2 (1+1)
ENG 101	Comprehension and Communication Skills in English	2 (1+1)
MATH 101	Mathematical Methods in Agriculture (For students from Bio stream)	4 (3+1)
BOT 101	Elementary Botany (For students from Math stream)	2 (1+1)
ZOO 101	Elementary Zoology (For students from Math stream)	2 (1+1)
SOC 101	Fundamentals of Rural Sociology and Educational Psychology	2 (2+0)
SOILS 101	Introduction to Soil Science	3 (2+1)
SST 101	Principles of Seed Technology	3 (2+1)
STAT 101	Introduction to Statistical Methods	2 (1+1)
NCC/NSS	National Cadet Corps/National Service Scheme	2 (0+2)
TUT	Tutorial	1(1+0) NC
	Total Credits	Bio Stream Math Stream 24 (14+10)/ 24 (15+9)
Semester II		
AG ECON 101	Principles of Agricultural Economics	2 (1+1)
AGRON 102	Principles of Agronomy	3 (2+1)
BIOCHEM 101	Biochemistry	3 (2+1)
ENT 101	Insect Morphology and Systematics	4 (3+1)
GP 101	Fundamentals of Genetics	3 (2+1)
LPM 101	Livestock Production and Management	3 (2+1)
MICRO 101	Elementary Microbiology	3 (2+1)
SOILS 102	Soil Fertility, Soil Chemistry and Nutrient Management	3 (2+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	25 (16+9)
Semester III		
AG ECON 201	Agricultural Finance and Co-operation	2 (1+1)
AGRON 201	Irrigation Water Management	3 (2+1)
AGRON 202	Field Crops - I (<i>Kharif Crops</i>)	3 (2+1)
GP 201	Principles of Plant Breeding	3 (2+1)
HORT 201	Production Technology of Fruit Crops	3 (2+1)
PL PATH 201	Plant Pathogens and Principles of Plant Pathology	4 (3+1)
SOILS 201	Manures, Fertilizers and Agro-Chemicals	3 (2+1)

VSC 201	Production Technology of Vegetable Crops	3 (2+1)
NCC/NSS	National Cadet Corps/National Service Scheme	2 (0+2)
TUT	Tutorial	1(1+0) NC
	Total Credits	26 (16+10)
Semester IV		
AG ECON 202	Agricultural Marketing, Trade and Prices	2 (1+1)
AGRON 203	Field Crops - II (<i>Rabi</i> Crops)	3 (2+1)
AGRON 204	Weed Management	2 (1+1)
ENT 201	Insect Ecology and Integrated Pest Management including Beneficial Insects	3 (2+1)
EXT 201	Dimensions of Agricultural Extension	3 (2+1)
GP 202	Breeding of Field Crops	3 (2+1)
HORT 202/ VSC 202/ AGRON 205	Production Technology of Spices, Medicinal, Aromatic and Plantation Crops	2 (1+1)
PL PATH 202	Diseases of Field Crops and their Management	3 (2+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	22 (13+9)
Semester V		
AG ECON 301	Production Economics and Farm Management	2 (1+1)
AGRON 301	Rain-fed Agriculture	2 (1+1)
AGRON 302	Organic Farming	2 (1+1)
AGRON 303	Practical Crop Production – I (<i>Kharif</i> Crops)	1 (0+1)
ENT 301	Crop and Stored Grain Pests and their Management	3 (2+1)
FOR 301	Social and Farm Forestry	3 (2+1)
GP 301	Principles of Plant Biotechnology	3 (2+1)
HORT 301/ VSC 301	Post Harvest Management of Fruits and Vegetables	2 (1+1)
PFE 304	Protected Cultivation and Post-harvest Technology	2 (1+1)
SWE 304	Fundamentals of Soil and Water Conservation Engineering	3 (2+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	24 (13+11)
Semester VI		
AG ECON 302	Fundamentals of Agribusiness Management	2 (1+1)
AGRON 304	Practical Crop Production - II (<i>Rabi</i> Crops)	1 (0+1)
AGRON 305	Farming Systems and Sustainable Agriculture	2 (1+1)
FOR 302	Environmental Science (To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soil Science)	2 (1+1) NC
EXT 301	Extension Methodologies for Transfer of Agricultural Technology	3 (2+1)
EXT 302	Entrepreneurship Development and Communication Skills	2 (1+1)
FMPE 303	Farm Power and Machinery	2 (1+1)
HORT 302	Ornamental Horticulture	2 (1+1)

NEMA 301	Introductory Nematology	3 (2+1)
PFE 305	Renewable Energy	2 (1+1)
PL PATH 301	Diseases of Horticultural Crops and their Management	3 (2+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	23 (12+11)
Semester VII		
Elective Courses: Module-wise for Experiential Learning		20
The students will have to choose one module out of modules I-IX		
TUT	Tutorial	1(1+0) NC
Module I. Agricultural Economics and Agri-Business (Agricultural Economics and Business Management)		
AG ECON 401	International Trade in Agriculture	3 (1+2)
AG ECON 402	Management of Agro-based Industry (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)
AG ECON 403	Agricultural Marketing Management	3 (1+2)
AG ECON 404	Financial Management of Agribusiness (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)
AG ECON 405	Natural Resources Economics and Management	3 (1+2)
AG ECON 406	Agricultural Project Formulation, Evaluation and Monitoring	3 (1+2)
	Total Credits	20 (8+12)
Module II. Agricultural Extension and Rural Sociology (Extension Education and Sociology)		
EXT 401	Extension Approaches for Agricultural Development	3 (1+2)
EXT 402	Agricultural Journalism	3 (1+2)
EXT 403	Visual and Graphic Communication	2 (1+1)
EXT 404	Information Communication Technology in Agriculture	3 (1+2)
EXT 405	Principles of Management and Group Dynamics	3 (2+1)
SOC 401	Government Policies and Programmes of Agricultural and Rural Development	3 (1+2)
SOC 402	Behavioural Skills	3 (1+2)
	Total Credits	20 (8+12)
Module III. Commercial Agriculture (Agronomy, Forestry, Horticulture, Vegetable Science and Seed Science & Technology)		
FOR 401	Nursery Technology for Commercial Forest Trees	3 (1+2)
FOR 402	Production Technology of Economic Forest Trees	4 (2+2)
HORT 401	Commercial Floriculture	3 (1+2)
HORT 402	Commercial Fruit Production	3 (1+2)
VSC 403	Commercial Production of Spices and Condiments	2 (1+1)
AGRON 404	Commercial Production of Medicinal and Aromatic Plants	2 (1+1)
SST 401	Seed Production and Certification	3 (1+2)
	Total Credits	20 (8+12)

Module IV. Crop Improvement (Genetics & Plant Breeding and Seed Science & Technology)		
GP 401	Crop Improvement	3 (1+2)
GP 402	Special Techniques in Plant Breeding	3 (1+2)
GP 403	Heterosis Breeding in Crop Plants	3 (1+2)
GP 404	Plant Genetic Resources	2 (1+1)
GP 405	Crop Improvement for Biotic and Abiotic Stress	3 (1+2)
SST 401	Seed Production and Certification	3 (1+2)
SST 402	Seed Testing and Quality Control	3 (1+2)
	Total Credits	20 (7+13)
Module V. Crop Production (Agronomy, Agricultural Meteorology, Seed Science & Technology and Soil Science)		
AGM 401	Crop Weather Interactions	3 (1+2)
AGM 402/ SOILS 401	Remote Sensing, GIS and Land Use Planning (To be taught jointly by Agricultural Meteorology and Soil Science)	3 (1+2)
AGRON 401	Crop Management	3 (1+2)
AGRON 402	Water Management	3 (1+2)
AGRON 403	Integrated Farming Systems	2 (1+1)
SOILS 402	Soil Management	3 (1+2)
SST 401	Seed Production and Certification	3 (1+2)
	Total Credits	20 (7+13)
Module VI. Horticulture (Horticulture and Vegetable Science)		
HORT 401	Commercial Floriculture	3 (1+2)
HORT 402	Commercial Fruit Production	3 (1+2)
HORT 403	Nursery Management of Horticultural Crops	3 (1+2)
HORT 404/ VSC 402	Processing and Value Addition in Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)
HORT 405/ VSC 404	Protected Cultivation of Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)
VSC 401	Commercial Vegetable Production	3 (1+2)
HORT406/ VSC 405	Seed Production of Vegetable and Flower Crops (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)
	Total Credits	20 (9+11)
Module VII. Plant Protection (Agronomy, Entomology, Nematology and Plant Pathology)		
AGRON 405	Chemical Weed Control	2 (1+1)
ENT 401	Integrated Pest and Disease Management (To be taught jointly by Entomology and Plant Pathology)	4 (2+2)
ENT 402	Management of Non-Insect and Storage Pests	2 (1+1)
ENT 403	Apiculture	2 (0+2)

ENT 404	Bio-Control Agents and Bio-Pesticides (To be taught jointly by Entomology, Nematology and Plant Pathology)	3 (1+2)
ENT 405	Pesticides and Plant Protection Equipment (To be taught jointly by Entomology and Plant Pathology)	2 (1+1)
NEMA 401	Nematode Pests of Crops and their Management	3 (1+2)
PL PATH 401	Mushroom Cultivation	2 (0+2)
	Total Credits	20 (7+13)
Module VIII. Post Harvest Technology and Value Addition (Food Science & Technology, Horticulture and Vegetable Science)		
HORT 409	Post Harvest Technology of Horticultural Crops	3 (1+2)
FST 401	Unit Operations in Processing and Development of New products	4 (1+3)
FST 402	Integrated Storage Management of Fruits and Vegetables	3 (1+2)
FST 403	Processing of Cereals, Pulses and Oilseed Crops including Millets	3 (1+2)
HORT 407	Post Harvest and Storage Technology of Cut and Dry Flowers	3 (1+2)
HORT 408/ VSC 406	Post Harvest Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Horticulture and Vegetable Science)	4 (1+3)
	Total Credits	20 (6+14)
Module IX. Basic Sciences (Bioinformatics, Microbiology and Molecular Biology & Biotechnology)		
BIOINFO 417	Bioinformatics	3 (1+2)
MBB 411	Essentials of Molecular Biology	2 (1+1)
MBB 412	Recombinant DNA Technology	3 (1+2)
MBB 413	Plant Tissue Culture and Genetic Transformation	4 (2+2)
MBB 414	Molecular Breeding	2 (1+1)
MBB 415	Microbial and Environmental Biotechnology	3 (1+2)
MBB 416	Molecular Diagnostics	2 (1+1)
MICRO 418	Production Technology of Bio-fertilizers	1 (0+1)
	Total Credits	20 (8+12)
Semester VIII		
AGRON 491	Rural Agricultural Work Experience (RAWWE) (To be taught jointly by Agronomy, Agricultural Economics and Extension Education)	20 (10 Credit and 10 Non Credit)
	Total Credits	20

B. Sc. (Hons.) Agriculture, 6-Year Programme
Courses: Semester-wise

Course No.	Course Title	Credits
Semester I		
BIO 1	Biology-I	3 (2+1)
CHEM 1	Principles of Chemistry-I	4 (3+1)
COMP 1	Computer Techniques-I	2 (0+2)
ENG 1	Composition and Elementary Grammar	3 (2+1)
MATH 1	Algebra and Trigonometry	3 (3+0)
PHY 1	Principles of Physics-I	4 (3+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits (Bio/Math streams)	17(10+7)/17(11+6)
Semester II		
BIO 2	Biology-II	3 (2+1)
CHEM 2	Principles of Chemistry-II	4 (3+1)
COMP 2	Computer Techniques-II	3 (0+3)
ENG 2	Applied Grammar and Comprehension	3 (2+1)
MATH 2	Coordinate Geometry, Calculus and Elementary Statistics	3 (3+0)
PHY 2	Principles of Physics-II	4 (3+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits (Bio/Math streams)	18(10+8)/18(11+7)
Semester III		
BIO 21	Biology-III	3 (2+1)
CHEM 21	Principles of Chemistry-III	4 (3+1)
COMP 21	Computer Techniques-III	2 (0+2)
ENG 21	English Composition and Comprehension	3 (2+1)
MATH 21	Matrices, Determinants, Differential Calculus and Probability	3 (3+0)
PHY 21	Principles of Physics-III	4 (3+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits (Bio/Math streams)	17(10+7)/17(11+6)
Semester IV		
BIO 22	Biology-IV	3 (2+1)
CHEM 22	Principles of Chemistry-IV	4 (3+1)
COMP 22	Computer Techniques-IV	3 (0+3)
ENG 22	Functional English	3 (2+1)
MATH 22	Integral Calculus, Vectors and 3D Geometry	3 (3+0)
PHY 22	Principles of Physics-IV	4 (3+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits (Bio/Math streams)	18(10+8)/18(11+7)
Semester V		
AGM 101	Principles of Agricultural Meteorology	3 (2+1)

AGRON 101	Introductory Agriculture	1 (1+0)
COMP 101	Introduction to Computer Applications	2 (1+1)
ENG 101	Comprehension and Communication Skills in English	2 (1+1)
MATH 101	Mathematical Methods in Agriculture (For students from Bio stream)	4 (3+1)
BOT 101	Elementary Botany (For students from Math stream)	2 (1+1)
ZOO 101	Elementary Zoology (For students from Math stream)	2 (1+1)
SOC 101	Fundamentals of Rural Sociology and Educational Psychology	2 (2+0)
SOILS 101	Introduction to Soil Science	3 (2+1)
SST 101	Principles of Seed Technology	3 (2+1)
STAT 101	Introduction to Statistical Methods	2 (1+1)
NCC/NSS	National Cadet Corps/National Service Scheme	2 (0+2)
TUT	Tutorial	1(1+0) NC
	Total Credits	24 (14+10)/ 24 (15+9)
Semester VI		
AG ECON 101	Principles of Agricultural Economics	2 (1+1)
AGRON 102	Principles of Agronomy	3 (2+1)
BIOCHEM 101	Biochemistry	3 (2+1)
ENT 101	Insect Morphology and Systematics	4 (3+1)
GP 101	Fundamentals of Genetics	3 (2+1)
LPM 101	Livestock Production and Management	3 (2+1)
MICRO 101	Elementary Microbiology	3 (2+1)
SOILS 102	Soil Fertility, Soil Chemistry and Nutrient Management	3 (2+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	25 (16+9)
Semester VII		
AG ECON 201	Agricultural Finance and Co-operation	2 (1+1)
AGRON 201	Irrigation Water Management	3 (2+1)
AGRON 202	Field Crops - I (<i>Kharif</i> Crops)	3 (2+1)
GP 201	Principles of Plant Breeding	3 (2+1)
HORT 201	Production Technology of Fruit Crops	3 (2+1)
PL PATH 201	Plant Pathogens and Principles of Plant Pathology	4 (3+1)
SOILS 201	Manures, Fertilizers and Agro-Chemicals	3 (2+1)
VSC 201	Production Technology of Vegetable Crops	3 (2+1)
NCC/NSS	National Cadet Corps/National Service Scheme	2 (0+2)
TUT	Tutorial	1(1+0) NC
	Total Credits	26 (16+10)
Semester VIII		
AG ECON 202	Agricultural Marketing, Trade and Prices	2 (1+1)
AGRON 203	Field Crops - II (<i>Rabi</i> Crops)	3 (2+1)
AGRON 204	Weed Management	2 (1+1)
ENT 201	Insect Ecology and Integrated Pest Management including Beneficial Insects	3 (2+1)
EXT 201	Dimensions of Agricultural Extension	3 (2+1)

GP 202	Breeding of Field Crops	3 (2+1)
HORT 202/ VSC 202/ AGRON 205	Production Technology of Spices, Medicinal, Aromatic and Plantation Crops	2 (1+1)
PL PATH 202	Diseases of Field Crops and their Management	3 (2+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	22 (13+9)
Semester IX		
AG ECON 301	Production Economics and Farm Management	2 (1+1)
AGRON 301	Rain-fed Agriculture	2 (1+1)
AGRON 302	Organic Farming	2 (1+1)
AGRON 303	Practical Crop Production – I (<i>Kharif</i> Crops)	1 (0+1)
ENT 301	Crop and Stored Grain Pests and their Management	3 (2+1)
FOR 301	Social and Farm Forestry	3 (2+1)
GP 301	Principles of Plant Biotechnology	3 (2+1)
HORT 301/ VSC 301	Post Harvest Management of Fruits and Vegetables	2 (1+1)
PFE 304	Protected Cultivation and Post-harvest Technology	2 (1+1)
SWE 304	Fundamentals of Soil and Water Conservation Engineering	3 (2+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	24 (13+11)
Semester X		
AG ECON 302	Fundamentals of Agribusiness Management	2 (1+1)
AGRON 304	Practical Crop Production - II (<i>Rabi</i> Crops)	1 (0+1)
AGRON 305	Farming Systems and Sustainable Agriculture	2 (1+1)
FOR 302	Environmental Science (To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soil Science)	2 (1+1) NC
EXT 301	Extension Methodologies for Transfer of Agricultural Technology	3 (2+1)
EXT 302	Entrepreneurship Development and Communication Skills	2 (1+1)
FMPE 303	Farm Power and Machinery	2 (1+1)
HORT 302	Ornamental Horticulture	2 (1+1)
NEMA 301	Introductory Nematology	3 (2+1)
PFE 305	Renewable Energy	2 (1+1)
PL PATH 301	Diseases of Horticultural Crops and their Management	3 (2+1)
CCA	Co-curricular Activity	1 (0+1)
TUT	Tutorial	1(1+0) NC
	Total Credits	23 (12+11)

Semester XI		
Elective Courses: Module-wise for Experiential Learning		20
The students will have to choose one module out of modules I-IX		
TUT	Tutorial	1(1+0) NC
Module I. Agricultural Economics and Agri-Business (Agricultural Economics and Business Management)		
AG ECON 401	International Trade in Agriculture	3 (1+2)
AG ECON 402	Management of Agro-based Industry (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)
AG ECON 403	Agricultural Marketing Management	3 (1+2)
AG ECON 404	Financial Management of Agribusiness (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)
AG ECON 405	Natural Resources Economics and Management	3 (1+2)
AG ECON 406	Agricultural Project Formulation, Evaluation and Monitoring	3 (1+2)
Total Credits		20 (8+12)
Module II. Agricultural Extension and Rural Sociology (Extension Education and Sociology)		
EXT 401	Extension Approaches for Agricultural Development	3 (1+2)
EXT 402	Agricultural Journalism	3 (1+2)
EXT 403	Visual and Graphic Communication	2 (1+1)
EXT 404	Information Communication Technology in Agriculture	3 (1+2)
EXT 405	Principles of Management and Group Dynamics	3 (2+1)
SOC 401	Government Policies and Programmes of Agricultural and Rural Development	3 (1+2)
SOC 402	Behavioural Skills	3 (1+2)
Total Credits		20 (8+12)
Module III. Commercial Agriculture (Agronomy, Forestry, Horticulture, Vegetable Science and Seed Science & Technology)		
FOR 401	Nursery Technology for Commercial Forest Trees	3 (1+2)
FOR 402	Production Technology of Economic Forest Trees	4 (2+2)
HORT 401	Commercial Floriculture	3 (1+2)
HORT 402	Commercial Fruit Production	3 (1+2)
VSC 403	Commercial Production of Spices and Condiments	2 (1+1)
AGRON 404	Commercial Production of Medicinal and Aromatic Plants	2 (1+1)
SST 401	Seed Production and Certification	3 (1+2)
Total Credits		20 (8+12)
Module IV. Crop Improvement (Genetics & Plant Breeding and Seed Science & Technology)		
GP 401	Crop Improvement	3 (1+2)
GP 402	Special Techniques in Plant Breeding	3 (1+2)
GP 403	Heterosis Breeding in Crop Plants	3 (1+2)
GP 404	Plant Genetic Resources	2 (1+1)
GP 405	Crop Improvement for Biotic and Abiotic Stress	3 (1+2)

SST 401	Seed Production and Certification	3 (1+2)
SST 402	Seed Testing and Quality Control	3 (1+2)
	Total Credits	20 (7+13)
Module V. Crop Production (Agronomy, Agricultural Meteorology, Seed Science & Technology and Soil Science)		
AGM 401	Crop Weather Interactions	3 (1+2)
AGM 402/ SOILS 401	Remote Sensing, GIS and Land Use Planning (To be taught jointly by Agricultural Meteorology and Soil Science)	3 (1+2)
AGRON 401	Crop Management	3 (1+2)
AGRON 402	Water Management	3 (1+2)
AGRON 403	Integrated Farming Systems	2 (1+1)
SOILS 402	Soil Management	3 (1+2)
SST 401	Seed Production and Certification	3 (1+2)
	Total Credits	20 (7+13)
Module VI. Horticulture (Horticulture and Vegetable Science)		
HORT 401	Commercial Floriculture	3 (1+2)
HORT 402	Commercial Fruit Production	3 (1+2)
HORT 403	Nursery Management of Horticultural Crops	3 (1+2)
HORT 404/ VSC 402	Processing and Value Addition in Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)
HORT 405/ VSC 404	Protected Cultivation of Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)
VSC 401	Commercial Vegetable Production	3 (1+2)
HORT406/ VSC 405	Seed Production of Vegetable and Flower Crops (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)
	Total Credits	20 (9+11)
Module VII. Plant Protection (Agronomy, Entomology, Nematology and Plant Pathology)		
AGRON 405	Chemical Weed Control	2 (1+1)
ENT 401	Integrated Pest and Disease Management (To be taught jointly by Entomology and Plant Pathology)	4 (2+2)
ENT 402	Management of Non-Insect and Storage Pests	2 (1+1)
ENT 403	Apiculture	2 (0+2)
ENT 404	Bio-Control Agents and Bio-Pesticides (To be taught jointly by Entomology, Nematology and Plant Pathology)	3 (1+2)
ENT 405	Pesticides and Plant Protection Equipment (To be taught jointly by Entomology and Plant Pathology)	2 (1+1)
NEMA 401	Nematode Pests of Crops and their Management	3 (1+2)
PL PATH 401	Mushroom Cultivation	2 (0+2)
	Total Credits	20 (7+13)

Module VIII. Post Harvest Technology and Value Addition (Food Science & Technology, Horticulture and Vegetable Science)		
HORT 409	Post Harvest Technology of Horticultural Crops	3 (1+2)
FST 401	Unit Operations in Processing and Development of New products	4 (1+3)
FST 402	Integrated Storage Management of Fruits and Vegetables	3 (1+2)
FST 403	Processing of Cereals, Pulses and Oilseed Crops including Millets	3 (1+2)
HORT 407	Post Harvest and Storage Technology of Cut and Dry Flowers	3 (1+2)
HORT 408/ VSC 406	Post Harvest Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Horticulture and Vegetable Science)	4 (1+3)
	Total Credits	20 (6+14)
Module IX. Basic Sciences (Bioinformatics, Microbiology and Molecular Biology & Biotechnology)		
BIOINFO 417	Bioinformatics	3 (1+2)
MBB 411	Essentials of Molecular Biology	2 (1+1)
MBB 412	Recombinant DNA Technology	3 (1+2)
MBB 413	Plant Tissue Culture and Genetic Transformation	4 (2+2)
MBB 414	Molecular Breeding	2 (1+1)
MBB 415	Microbial and Environmental Biotechnology	3 (1+2)
MBB 416	Molecular Diagnostics	2 (1+1)
MICRO 418	Production Technology of Bio-fertilizers	1 (0+1)
	Total Credits	20 (8+12)
Semester XII		
AGRON 491	Rural Agricultural Work Experience (RAWWE) (To be taught jointly by Agronomy, Agricultural Economics and Extension Education)	20 (10 Credit and 10 Non credit)
	Total Credits	20

B. Sc. (Hons.) Agriculture, 6-Year Programme
Bridge Courses: Department-wise

Course No.	Course Title	Credits	Semester
Basic Sciences & Humanities			
Biology			
BIO 1	Biology-I (To be taught jointly by Botany & Plant Physiology and Zoology)	3 (2+1)	I
BIO 2	Biology-II (To be taught jointly by Botany & Plant Physiology and Zoology)	3 (2+1)	II
BIO 21	Biology-III (To be taught jointly by Botany & Plant Physiology and Zoology)	3 (2+1)	III

BIO 22	Biology-IV (To be taught jointly by Botany & Plant Physiology and Zoology)	3 (2+1)	IV
	Total Credits	12 (8+4)	
Chemistry & Physics			
Chemistry			
CHEM 1	Principles of Chemistry-I	4 (3+1)	I
CHEM 2	Principles of Chemistry-II	4 (3+1)	II
CHEM 21	Principles of Chemistry-III	4 (3+1)	III
CHEM 22	Principles of Chemistry-IV	4 (3+1)	IV
	Total Credits	16(12+4)	
Physics			
PHY 1	Principles of Physics-I	4(3+1)	I
PHY 2	Principles of Physics-II	4(3+1)	II
PHY 21	Principles of Physics-III	4(3+1)	III
PHY 22	Principles of Physics-IV	4(3+1)	IV
	Total Credits	16(12+4)	
Computer			
COMP 1	Computer Techniques-I	2(0+2)	I
COMP 2	Computer Techniques-II	3(0+3)	II
COMP 21	Computer Techniques-III	2(0+2)	III
COMP 22	Computer Techniques-IV	3(0+3)	IV
	Total Credits	10(0+10)	
English (Languages & Haryanavi Culture)			
ENG 1	Composition and Elementary Grammar	3(2+1)	I
ENG 2	Applied Grammar and Comprehension	3(2+1)	II
ENG 21	English Composition and Comprehension	3(2+1)	III
ENG 22	Functional English	3(2+1)	IV
	Total Credits	12(8+4)	
Mathematics (Mathematics & Statistics)			
MATH 1	Algebra and Trigonometry	3(3+0)	I
MATH 2	Coordinate Geometry, Calculus and Elementary Statistics	3(3+0)	II
MATH 21	Matrices, Determinants, Differential Calculus and Probability	3(3+0)	III
MATH 22	Integral Calculus, Vectors and 3D Geometry	3(3+0)	IV
	Total Credits	12 (12+0)	

**Core Courses for B. Sc. (Hons.) Agriculture
4-Year Programme/6-Year Programme: Department-wise**

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Agriculture			
Agricultural Economics			
AG ECON 101	Principles of Agricultural Economics	2 (1+1)	II/VI
AG ECON 201	Agricultural Finance and Co-operation	2 (1+1)	III/VII
AG ECON 202	Agricultural Marketing, Trade and Prices	2 (1+1)	IV/VIII

AG ECON 301	Production Economics and Farm Management	2 (1+1)	V/IX
AG ECON 302	Fundamentals of Agribusiness Management (To be taught jointly by Agricultural Economics and Business Management)	2 (1+1)	VI/X
	Total Credits	10 (5+5)	
Agricultural Meteorology			
AGM 101	Principles of Agricultural Meteorology	3 (2+1)	I/V
	Total Credits	3 (2+1)	
Agronomy			
AGRON 101	Introductory Agriculture	1 (1+0)	I/V
AGRON 102	Principles of Agronomy	3 (2+1)	II/VI
AGRON 201	Irrigation Water Management	3 (2+1)	III/VII
AGRON 202	Field Crops - I (<i>Kharif</i> Crops)	3 (2+1)	III/VII
AGRON 203	Field Crops - II (<i>Rabi</i> Crops)	3 (2+1)	IV/VIII
AGRON 204	Weed Management	2 (1+1)	IV/VIII
AGRON 205/ HORT 202/ VSC 202/	Production Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Agronomy, Horticulture and Vegetable Science)	2 (1+1)	IV/VIII
AGRON 301	Rainfed Agriculture	2 (1+1)	V/IX
AGRON 302	Organic Farming	2 (1+1)	V/IX
AGRON 303	Practical Crop Production - I (<i>Kharif</i> Crops)	1 (0+1)	V/IX
AGRON 304	Practical Crop Production - II (<i>Rabi</i> Crops)	1 (0+1)	VI/X
AGRON 305	Farming Systems and Sustainable Agriculture	2 (1+1)	VI/X
	Total Credits	25 (14+11)	
AGRON 491	Rural Agricultural Work Experience (To be conducted jointly by Agricultural Economics, Agronomy and Extension Education)	20 (10 Credit and 10 Non Credit)	VIII/XII
	Total Credits	20	
Entomology			
ENT 101	Insect Morphology and Systematics	4 (3+1)	II/VI
ENT 201	Insect Ecology and Integrated Pest Management including Beneficial Insects	3 (2+1)	IV/VIII
ENT 301	Crop and Stored Grain Pests and their Management	3 (2+1)	V/IX
	Total Credits	10 (7+3)	
Extension Education			
EXT 201	Dimensions of Agricultural Extension	3 (2+1)	IV/VIII
EXT 301	Extension Methodologies for Transfer of Agricultural Technology	3 (2+1)	VI/X
EXT 302	Entrepreneurship Development and Communication Skills	2 (1+1)	VI/X
	Total Credits	8 (5+3)	

Forestry			
FOR 301	Social and Farm Forestry	3 (2+1)	V/IX
FOR 302	Environmental Science (To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soil Science)	2 (1+1) NC	VI/X
	Total Credits	5 (3+2)	
Genetics & Plant Breeding			
GP 101	Fundamentals of Genetics	3 (2+1)	II/VI
GP 201	Principles of Plant Breeding	3 (2+1)	III/VII
GP 202	Breeding of Field Crops	3 (2+1)	IV/VIII
GP 301	Principles of Plant Biotechnology	3 (2+1)	V/IX
	Total Credits	12 (8+4)	
Horticulture			
HORT 201	Production Technology of Fruit Crops	3 (2+1)	III/VII
HORT 202/ AGRON 205/ VSC 202	Production Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Agronomy, Horticulture and Vegetable Science)	2 (1+1)	IV/VIII
HORT 301/ VSC 301	Post Harvest Management of Fruits and Vegetables	2 (1+1)	V/IX
HORT 302	Ornamental Horticulture	2 (1+1)	VI/X
	Total Credits	9 (5+4)	
Nematology			
NEMA 301	Introductory Nematology	3 (2+1)	VI/X
	Total Credits	3 (2+1)	
Plant Pathology			
PL PATH 201	Plant Pathogens and Principles of Plant Pathology	4 (3+1)	III/VII
PL PATH 202	Diseases of Field Crops and their Management	3 (2+1)	IV/VIII
PL PATH 301	Diseases of Horticultural Crops and their Management	3 (2+1)	VI/X
	Total Credits	10 (7+3)	
Seed Science & Technology			
SST 101	Principles of Seed Technology	3 (2+1)	I/V
	Total Credits	3 (2+1)	
Soil Science			
SOILS 101	Introduction to Soil Science	3 (2+1)	I/V
SOILS 102	Soil Fertility, Soil Chemistry and Nutrient Management	3 (2+1)	II/VI
SOILS 201	Manures, Fertilizers and Agro-Chemicals	3 (2+1)	III/VII
	Total Credits	9 (6+3)	
Vegetable Science			
VSC 201	Production Technology of Vegetable Crops	3 (2+1)	III/VII

VSC 202/ AGRON 205/ HORT 202	Production Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Agronomy, Horticulture and Vegetable Science)	2 (1+1)	IV/VIII
VSC 301/ HORT 301	Post Harvest Management of Fruits and Vegetables (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)	V/IX
	Total Credits	7 (4+3)	
Agricultural Engineering and Technology			
Farm Machinery & Power Engineering			
FMPE 303	Farm Power and Machinery	2 (1+1)	VI/X
	Total Credits	2 (1+1)	
Processing and Food Engineering			
PFE 304	Protected Cultivation and Post-harvest Technology	2 (1+1)	V/IX
PFE 305	Renewable Energy	2 (1+1)	VI/X
	Total Credits	4 (2+2)	
Soil and Water Engineering			
SWE 304	Fundamentals of Soil and Water Conservation Engineering	3 (2+1)	V/IX
	Total Credits	3 (2+1)	
Basic Sciences & Humanities			
Biochemistry			
BIOCHEM 101	Biochemistry	3 (2+1)	II/VI
	Total Credits	3 (2+1)	
Botany and Plant Physiology			
BOT 101	Elementary Botany (For students from Math stream)	2 (1+1)	I/V
	Total Credits	2 (1+1)	
Computer			
COMP 101	Introduction to Computer Applications	2 (1+1)	I/V
	Total Credits	2 (1+1)	
English (Languages & Haryanavi Culture)			
ENG 101	Comprehension and Communication Skills in English	2 (1+1)	I/V
	Total Credits	2 (1+1)	
Mathematics & Statistics			
Mathematics			
MATH 101	Mathematical Methods in Agriculture (For students from Biology stream)	4 (3+1)	I/V
	Total Credits	4 (3+1)	
Statistics			
STAT 101	Introduction to Statistical Methods	2 (1+1)	I/V
	Total Credits	2 (1+1)	
Microbiology			
MICRO 101	Elementary Microbiology	3 (2+1)	II/VI
	Total Credits	3 (2+1)	

Sociology			
SOC 101	Fundamentals of Rural Sociology and Educational Psychology	2 (2+0)	I/V
	Total Credits	2 (2+0)	
Zoology			
ZOO 101	Elementary Zoology (For students from Math stream)	2 (1+1)	I/V
	Total Credits	2 (1+1)	
Others			
LPM 101	Livestock Production and Management	3 (2+1)	II/VI
	Total Credits	3 (2+1)	

Elective Courses (Experiential Learning): Module-wise (Modules I - IX) for B. Sc. (Hons.) Agriculture 4-Year/6-Year Programme

Module I. Agricultural Economics and Agri-Business (Agricultural Economics and Business Management)			
Course No.	Course Title	Credits	Semester (4-yr/6-yr)
AG ECON 401	International Trade in Agriculture	3 (1+2)	VII/XI
AG ECON 402	Management of Agro-based Industry (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)	VII/XI
AG ECON 403	Agricultural Marketing Management	3 (1+2)	VII/XI
AG ECON 404	Financial Management of Agribusiness (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)	VII/XI
AG ECON 405	Natural Resources Economics and Management	3 (1+2)	VII/XI
AG ECON 406	Agricultural Project Formulation, Evaluation and Monitoring	3 (1+2)	VII/XI
	Total Credits	20 (8+12)	
Module II. Agricultural Extension and Rural Sociology (Extension Education and Sociology)			
EXT 401	Extension Approaches for Agricultural Development	3 (1+2)	VII/XI
EXT 402	Agricultural Journalism	3 (1+2)	VII/XI
EXT 403	Visual and Graphic Communication	2 (1+1)	VII/XI
EXT 404	Information Communication Technology in Agriculture	3 (1+2)	VII/XI
EXT 405	Principles of Management and Group Dynamics	3 (2+1)	VII/XI
SOC 401	Government Policies and Programmes of Agricultural and Rural Development	3 (1+2)	VII/XI
SOC 402	Behavioural Skills	3 (1+2)	VII/XI
	Total Credits	20 (8+12)	

Module III. Commercial Agriculture (Agronomy, Forestry, Horticulture, Vegetable Science and Seed Science & Technology)			
FOR 401	Nursery Technology for Commercial Forest Trees	3 (1+2)	VII/XI
FOR 402	Production Technology of Economic Forest Trees	4 (2+2)	VII/XI
HORT 401	Commercial Floriculture	3 (1+2)	VII/XI
HORT 402	Commercial Fruit Production	3 (1+2)	VII/XI
VSC 403	Commercial Production of Spices and Condiments	2 (1+1)	VII/XI
AGRON 404	Commercial Production of Medicinal and Aromatic Plants	2 (1+1)	VII/XI
SST 401	Seed Production and Certification	3 (1+2)	VII/XI
	Total Credits	20 (8+12)	
Module IV. Crop Improvement (Genetics & Plant Breeding and Seed Science & Technology)			
GP 401	Crop Improvement	3 (1+2)	VII/XI
GP 402	Special Techniques in Plant Breeding	3 (1+2)	VII/XI
GP 403	Heterosis Breeding in Crop Plants	3 (1+2)	VII/XI
GP 404	Plant Genetic Resources	2 (1+1)	VII/XI
GP 405	Crop Improvement for Biotic and Abiotic Stress	3 (1+2)	VII/XI
SST 401	Seed Production and Certification	3 (1+2)	VII/XI
SST 402	Seed Testing and Quality Control	3 (1+2)	VII/XI
	Total Credits	20 (7+13)	
Module V. Crop Production (Agronomy, Agricultural Meteorology, Seed Science & Technology and Soil Science)			
AGM 401	Crop Weather Interactions	3 (1+2)	VII/XI
AGM 402/ SOILS 401	Remote Sensing, GIS and Land Use Planning (To be taught jointly by Agricultural Meteorology and Soil Science)	3 (1+2)	VII/XI
AGRON 401	Crop Management	3 (1+2)	VII/XI
AGRON 402	Water Management	3 (1+2)	VII/XI
AGRON 403	Integrated Farming Systems	2 (1+1)	VII/XI
SOILS 402	Soil Management	3 (1+2)	VII/XI
SST 401	Seed Production and Certification	3 (1+2)	VII/XI
	Total Credits	20 (7+13)	
Module VI. Horticulture (Horticulture and Vegetable Science)			
HORT 401	Commercial Floriculture	3 (1+2)	VII/XI
HORT 402	Commercial Fruit Production	3 (1+2)	VII/XI
HORT 403	Nursery Management of Horticultural Crops	3 (1+2)	VII/XI
HORT 404/ VSC 402	Processing and Value Addition in Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)	VII/XI

HORT 405/ VSC 404	Protected Cultivation of Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)	VII/XI
VSC 401	Commercial Vegetable Production	3 (1+2)	VII/XI
HORT406/ VSC 405	Seed Production of Vegetable and Flower Crops (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)	VII/XI
	Total Credits	20 (9+11)	
Module VII. Plant Protection (Agronomy, Entomology, Nematology and Plant Pathology)			
AGRON 405	Chemical Weed Control	2 (1+1)	VII/XI
ENT 401	Integrated Pest and Disease Management (To be taught jointly by Entomology and Plant Pathology)	4 (2+2)	VII/XI
ENT 402	Management of Non-Insect and Storage Pests	2 (1+1)	VII/XI
ENT 403	Apiculture	2 (0+2)	VII/XI
ENT 404	Bio-Control Agents and Bio-Pesticides (To be taught jointly by Entomology, Nematology and Plant Pathology)	3 (1+2)	VII/XI
ENT 405	Pesticides and Plant Protection Equipment (To be taught jointly by Entomology and Plant Pathology)	2 (1+1)	VII/XI
NEMA 401	Nematode Pests of Crops and their Management	3 (1+2)	VII/XI
PL PATH 401	Mushroom Cultivation	2 (0+2)	VII/XI
	Total Credits	20 (7+13)	
Module VIII. Post Harvest Technology and Value Addition (Food Science & Technology, Horticulture and Vegetable Science)			
HORT 409	Post Harvest Technology of Horticultural Crops	3 (1+2)	VII/XI
FST 401	Unit Operations in Processing and Development of New products	4 (1+3)	VII/XI
FST 402	Integrated Storage Management of Fruits and Vegetables	3 (1+2)	VII/XI
FST 403	Processing of Cereals, Pulses and Oilseed Crops including Millets	3 (1+2)	VII/XI
HORT 407	Post Harvest and Storage Technology of Cut and Dry Flowers	3 (1+2)	VII/XI
HORT 408/ VSC 406	Post Harvest Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Horticulture and Vegetable Science)	4 (1+3)	VII/XI
	Total Credits	20 (6+14)	
Module IX. Basic Sciences (Bioinformatics, Microbiology and Molecular Biology & Biotechnology)			
BIOINFO 417	Bioinformatics	3 (1+2)	VII/XI
MBB 411	Essentials of Molecular Biology	2 (1+1)	VII/XI

MBB 412	Recombinant DNA Technology	3 (1+2)	VII/XI
MBB 413	Plant Tissue Culture and Genetic Transformation	4 (2+2)	VII/XI
MBB 414	Molecular Breeding	2 (1+1)	VII/XI
MBB 415	Microbial and Environmental Biotechnology	3 (1+2)	VII/XI
MBB 416	Molecular Diagnostics	2 (1+1)	VII/XI
MICRO 418	Production Technology of Bio-fertilizers	1 (0+1)	VII/XI
	Total Credits	20 (8+12)	

**Elective Courses (Experiential Learning) for
B. Sc. (Hons.) Agriculture 4-Year/6-Year Programme: Department-wise**

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Agriculture			
Agricultural Economics			
AG ECON 401	International Trade in Agriculture	3 (1+2)	VII/XI
AG ECON 402	Management of Agro-based Industry (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)	VII/XI
AG ECON 403	Agricultural Marketing Management	3 (1+2)	VII/XI
AG ECON 404	Financial Management of Agribusiness (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)	VII/XI
AG ECON 405	Natural Resources Economics and Management	3 (1+2)	VII/XI
AG ECON 406	Agricultural Project Formulation, Evaluation and Monitoring	3 (1+2)	VII/XI
	Total Credits	20 (8+12)	
Agricultural Meteorology			
AGM 401	Crop Weather Interactions	3 (1+2)	VII/XI
AGM 402/ SOILS 401	Remote Sensing, GIS and Land Use Planning (To be taught jointly by Agricultural Meteorology and Soil Science)	3 (1+2)	VII/XI
	Total Credits	6 (2+4)	
Agronomy			
AGRON 401	Crop Management	3 (1+2)	VII/XI
AGRON 402	Water Management	3 (1+2)	VII/XI
AGRON 403	Integrated Farming Systems	2 (1+1)	VII/XI
AGRON 404	Commercial Production of Medicinal and Aromatic Plants	2 (1+1)	VII/XI
AGRON 405	Chemical Weed Control	2(1+1)	VII/XI
	Total Credits	12 (5+7)	

Entomology			
ENT 401	Integrated Pest and Disease Management (To be taught jointly by Entomology, Nematology and Plant Pathology)	4 (2+2)	VII/XI
ENT 402	Management of Non-Insect and Storage Pests	2 (1+1)	VII/XI
ENT 403	Apiculture	2 (0+2)	VII/XI
ENT 404	Bio-Control Agents and Bio-Pesticides (To be taught jointly by Entomology, Nematology and Plant Pathology)	3 (1+2)	VII/XI
ENT 405	Pesticides and Plant Protection Equipment (To be taught jointly by Entomology and Plant Pathology)	2 (1+1)	VII/XI
	Total Credits	13 (5+8)	
Extension Education			
EXT 401	Extension Approaches for Agricultural Development	3 (1+2)	VII/XI
EXT 402	Agricultural Journalism	3 (1+2)	VII/XI
EXT 403	Visual and Graphic Communication	2 (1+1)	VII/XI
EXT 404	Information Communication Technology in Agriculture	3 (1+2)	VII/XI
EXT 405	Principles of Management and Group Dynamics	3 (2+1)	VII/XI
	Total Credits	14 (6+8)	
Forestry			
FOR 401	Nursery Technology for Commercial Forest Trees	3 (1+2)	VII/XI
FOR 402	Production Technology of Economic Forest Trees	4 (2+2)	VII/XI
	Total Credits	7 (3+4)	
Genetics & Plant Breeding			
GP 401	Crop Improvement	3 (1+2)	VII/XI
GP 402	Special Techniques in Plant Breeding	3 (1+2)	VII/XI
GP 403	Heterosis Breeding in Crop Plants	3 (1+2)	VII/XI
GP 404	Plant Genetic Resources	2 (1+1)	VII/XI
GP 405	Crop Improvement for Biotic and Abiotic Stress	3 (1+2)	VII/XI
	Total Credits	14 (5+9)	
Horticulture			
HORT 401	Commercial Floriculture	3 (1+2)	VII/XI
HORT 402	Commercial Fruit Production	3 (1+2)	VII/XI
HORT 403	Nursery Management of Horticultural Crops	3 (1+2)	VII/XI
HORT 404/ VSC 402	Processing and Value Addition in Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)	VII/XI
HORT 405/ VSC 404	Protected Cultivation of Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)	VII/XI

HORT406/ VSC 405	Seed Production of Vegetable and Flower Crops (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)	VII/XI
HORT 407	Post Harvest and Storage Technology of Cut and Dry Flowers	3 (1+2)	VII/XI
HORT 408/ VSC 406	Post Harvest Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Horticulture and Vegetable Science)	4 (1+3)	VII/XI
HORT 409	Post Harvest Technology of Horticultural Crops	3 (1+2)	VII/XI
	Total Credits	27 (11+16)	
Nematology			
NEMA 401	Nematode Pests of Crops and their Management	3 (1+2)	VII/XI
	Total Credits	3 (1+2)	
Plant Pathology			
PL PATH 401	Mushroom Cultivation	2 (0+2)	VII/XI
	Total Credits	2 (0+2)	
Seed Science & Technology			
SST 401	Seed Production and Certification	3 (1+2)	VII/XI
SST 402	Seed Testing and Quality Control	3 (1+2)	VII/XI
	Total Credits	6 (2+4)	
Soil Science			
SOILS 401/ AGM 402	Remote Sensing, GIS and Land Use Planning (To be taught jointly by Agricultural Meteorology and Soil Science)	3 (1+2)	VII/XI
SOILS 402	Soil Management	3 (1+2)	VII/XI
	Total Credits	6 (2+4)	
Vegetable Science			
VSC 401	Commercial Vegetable Production	3 (1+2)	VII/XI
VSC 402/ HORT 404	Processing and Value Addition in Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)	VII/XI
VSC 403	Commercial Production of Spices and Condiments	2 (1+1)	VII/XI
VSC 404/ HORT 405	Protected Cultivation of Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)	VII/XI
VSC 405/ HORT406	Seed Production of Vegetable and Flower Crops (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)	VII/XI
VSC 406/ HORT 408	Post Harvest Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Horticulture and Vegetable Science)	4 (1+3)	VII/XI
	Total Credits	17 (8+9)	

Basic Sciences & Humanities			
Bioinformatics			
BIOINFO 417	Bioinformatics	3 (1+2)	VII/XI
	Total Credits	3 (1+2)	
Microbiology			
MICRO 418	Production Technology of Bio-fertilizers	1 (0+1)	VII/XI
	Total Credits	1 (0+1)	
Molecular Biology & Biotechnology			
MBB 411	Essentials of Molecular Biology	2 (1+1)	VII/XI
MBB 412	Recombinant DNA Technology	3 (1+2)	VII/XI
MBB 413	Plant Tissue Culture and Genetic Transformation	4 (2+2)	VII/XI
MBB 414	Molecular Breeding	2 (1+1)	VII/XI
MBB 415	Microbial and Environmental Biotechnology	3 (1+2)	VII/XI
MBB 416	Molecular Diagnostics	2 (1+1)	VII/XI
	Total Credits	16 (7+9)	
Sociology			
SOC 401	Government Policies and Programmes of Agricultural and Rural Development	3 (1+2)	VII/XI
SOC 402	Behavioural Skills	3 (1+2)	VII/XI
	Total Credits	6 (2+4)	
Centre for Food Science & Technology			
FST 401	Unit Operations in Processing and Development of New products	4 (1+3)	VII/XI
FST 402	Integrated Storage Management of Fruits and Vegetables	3 (1+2)	VII/XI
FST 403	Processing of Cereals, Pulses and Oilseed Crops including Millets	3 (1+2)	VII/XI
	Total Credits	10 (3+7)	

**Core Courses for B. Tech. (Agricultural Engineering)
Programme: Department-wise**

Course No.	Course Title	Credits	Semester
Agricultural Economics			
AG ECON 203	Agribusiness Management and Trade	3 (3+0)	III
	Total Credits	3 (3+0)	
Agronomy			
AGRON 103	Agriculture for Engineers (To be taught jointly by Agronomy, Horticulture and Soil Science)	4 (3+1)	II
	Total Credits	4 (3+1)	

Forestry			
FOR 302	Environmental Science (To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soils Science)	2 (1+1) NC	VI
	Total Credits	2 (1+1)	

Core Courses for B. Sc. (Hons.) Home Science: Department-wise

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Agricultural Economics			
AG ECON 303/ MGT 301	Marketing and Sales Management (To be taught jointly by Agricultural Economics and Business Management)	2 (1+1)	VI/X
	Total Credits	2 (1+1)	
Agronomy			
AGRON 206	Crop Production	2 (1+1)	IV/VIII
	Total Credits	2 (1+1)	
Business Management			
MGT 301/ AG ECON 303	Marketing and Sales Management (To be taught jointly by Agricultural Economics and Business Management)	2 (1+1)	VI/X
	Total Credits	2 (1+1)	
Entomology			
ENT 202/ NEMA 201/ PL PATH 203	Plant Protection (To be taught jointly by Entomology, Plant Pathology and Nematology-40: 40:20)	2 (0+2)	VI/X
	Total Credits	2 (0+2)	
Forestry			
FOR 302	Environmental Science (To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soils Science)	2 (1+1) NC	VI/X
	Total Credits	2 (1+1)	
Horticulture			
HORT 101/ VSC 101	Fruit and Vegetable Production (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)	IV/VIII
	Total Credits	2 (1+1)	
Nematology			
NEMA 201/ ENT 202/ PL PATH 203	Plant Protection (To be taught jointly by Entomology, Plant Pathology and Nematology-40: 40:20)	2 (0+2)	VI/X
	Total Credits	2 (0+2)	

Plant Pathology			
PL PATH 203/ ENT 202/ NEMA 201	Plant Protection (To be taught jointly by Entomology, Plant Pathology and Nematology-40: 40:20)	2 (0+2)	VI/X
	Total Credits	2 (0+2)	
Vegetable Science			
VSC 101/ HORT 101	Fruit and Vegetable Production (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)	IV/VIII
	Total Credits	2 (1+1)	

COURSE CONTENTS: DEPARTMENT-WISE
AGRICULTURAL ECONOMICS

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
AG ECON 101	Principles of Agricultural Economics	2 (1+1)	II/VI
AG ECON 201	Agricultural Finance and Co-operation	2 (1+1)	III/VII
AG ECON 202	Agricultural Marketing, Trade and Prices	2 (1+1)	IV/VIII
AG ECON 203	Agribusiness Management and Trade (For B.Tech. Agricultural Engineering)	3(3+0)	III/-
AG ECON 301	Production Economics and Farm Management	2 (1+1)	V/IX
AG ECON 302	Fundamentals of Agribusiness Management (To be taught jointly by Agricultural Economics and Business Management)	2 (1+1)	VI/X
AG ECON 303/ MGT 301	Marketing and Sales Management (To be taught jointly by Agricultural Economics and Business Management) (For B. Sc. (Hons.) Home Science)	2 (1+1)	VI/X
	Total Credits	15 (9+6)	
Elective Courses/Experiential Learning			
AG ECON 401	International Trade in Agriculture	3 (1+2)	VII/XI
AG ECON 402	Management of Agro-based Industry (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)	VII/XI
AG ECON 403	Agricultural Marketing Management	3 (1+2)	VII/XI
AG ECON 404	Financial Management of Agribusiness (To be taught jointly by Agricultural Economics and Business Management)	4 (2+2)	VII/XI
AG ECON 405	Natural Resources Economics and Management	3 (1+2)	VII/XI
AG ECON 406	Agricultural Project Formulation, Evaluation and Monitoring	3 (1+2)	VII/XI
	Total Credits	20 (8+12)	

AG ECON 101

**PRINCIPLES OF AGRICULTURAL
ECONOMICS**

**SEM II/VI
2(1+1)**

Theory

Economics and agricultural economics: meaning, definition, subject matter, division, importance and relationship with other sciences; law of diminishing marginal utility: meaning, definition, assumptions, limitations, importance; consumer's surplus: meaning, definition, importance; demand: meaning, definition, kinds of demand, demand schedule, demand curve, law of demand, extension and contraction vs increase and decrease in demand; elasticity of demand: types of elasticity of demand, degrees of price elasticity of demand, methods of measuring elasticity, factors influencing elasticity of demand, importance of elasticity of demand; supply: meaning, definition, law of supply, elasticity of supply; national income: concepts, measurement; inflation: meaning, definition, kinds of inflation and effect of inflation; basic concepts of economic growth and development.

Practical

To study the factors affecting demand and supply and measuring their responsiveness to changes in prices, income and expenditure etc.; equilibrium concept and price determination; extension and contraction vs increase and decrease in demand and supply; measurement of elasticity of demand through different methods; application of law of diminishing marginal utility and its limitations, concept of consumer's surplus and its application; different concepts of national income, their relationship and measurement.

AG ECON 201

**AGRICULTURAL FINANCE AND CO-
OPERATION**

**SEM III/VII
2 (1+1)**

Theory

Agricultural finance: nature and scope; time value of money: compounding and discounting; agricultural credit: meaning, definition, need, classification and micro finance; credit analysis: 4R's, 5C's and 7P's of credit, repayment plans; history of financing agriculture in India; commercial banks: nationalization of commercial banks, lead bank scheme, regional rural banks, scale of finance; higher financing agencies-RBI, NABARD, AFC, Asian Development Bank, World Bank, Insurance and Credit Guarantee Corporation of India; assessment of crop losses: determination of compensation, crop insurance, advantages and limitations in application, estimation of crop yields; agricultural cooperation: philosophy and principles, history of Indian cooperative movement, pre-independence and post independence periods, cooperative credit structure-PACS, DCCB, SCB.

Practical

Factors governing use of capital and identification of credit needs, time value of money-compounding and discounting; tools of financial management: balance sheet, income statement and cash flow analysis; estimations of credit needs and determining unit costs (7 types), preparations and analysis of loan proposals (4R's) and types of repayment loans.

AG ECON 202

**AGRICULTURAL MARKETING, TRADE
AND PRICES**

**SEM IV/VIII
2 (1+1)**

Theory

Agricultural marketing: concepts and definition, scope and subject matter; market and marketing: meaning, definitions, dimensions and components of a market classification; market structure: conduct, performance, marketing functions, market functionaries or agencies; producer's surplus: meaning, types of producers' surplus, marketable surplus; marketed surplus: importance, factors effecting marketable surplus; marketing channels: meaning, definition, channels for different products; market integration: meaning, definition, types of market integration; marketing efficiency: meaning, definition, marketing costs, margins and price spread, factors affecting the cost of marketing; international trade: GATT, WTO, implications of AOA, market access; cooperative marketing: meaning and types; quality control: agricultural products, AGMARK, characteristics of agricultural products; agricultural prices: meaning, role and types, need for agricultural price policy; risk in marketing: meaning and importance, types of risk in marketing; speculations and hedging.

Practical

Identification of marketing channels, study of Rythu Bazars/Apani Mandi, regulated markets and unregulated markets; estimation of marketed and marketable surplus and factors affecting it; price spread analysis and estimation of marketing efficiency through different methods; time series analysis: indices, forecasting etc; visit to marketing institutions: NAFED, APEDA, study

marketing management: meaning, definitions, marketing mix, 4Ps of marketing, market segmentation and targeting; product life cycle; project: definitions, project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation; appraisal and evaluation techniques: NPV, BCR, IRR; characteristics of agricultural projects.

Practical

Study of input markets: seed, fertilizers, pesticides; study of output markets: grains, fruits, vegetables, flowers; study of product markets: retail trade commodity trading, value added products; preparation of projects: feasibility reports and project appraisal techniques; case study of agro-based industries.

**AG ECON 303/
MGT 301**

**MARKETING AND SALES
MANAGEMENT**

**SEM VI/X
2 (1+1)**

**(To be taught jointly by Agricultural Economics and Business Management)
(For B.Sc. (Hons.) Home Science)**

Theory

Meaning, significance and importance of markets and marketing; marketing mix and marketing environment; market research, segmentation and targeting; buyer behavior: motives and factors influencing buying behaviour; demand and sales forecasting; pricing policies and pricing decisions; product planning: meaning, product concept and dimension, product policy; sales management: sales promotion mix, prerequisites of selling, after sales service, features of salesmanship, types of salesmen; entrepreneurship: meaning and importance, types and characteristics, role of entrepreneurial development; advertising: meaning, importance and classification/types; media and media selection.

Practical

Study of different markets, identification of channels of distribution; study of sale/product promotion techniques; comparative study on packaging material and packaging techniques; market survey for learning product related strategies: branding, trade name, warranty and guarantee; critical analysis of advertisement; preparation of advertisement; learning to plan advertisement budget.

AG ECON 401

**INTERNATIONAL TRADE IN
AGRICULTURE**

**SEM VII/XI
3 (1+2)**

Theory

Theory of international trade, process of liberalization, privatization and globalization (LPG), balance of payments, advantages of international trade, principal of comparative advantage-trade barriers, tariff rate quotas (TRQ), tariffication; policy of international trade in India: an overview of agricultural exports and imports in India, major constraints; Agro-Export Zones (AEZs), Special Economic Zone (SEZ), Export Promotion Council (EIC), Agricultural Processed Food Export Development Agency (APEDA), Marine Product Export Development Agency (MPEDA); emerging problems in the new economic regime: WTO agreement and implications to Indian agriculture, sanitary and phyto sanitary measures (SPS), technical barriers to trade (TBT), Pre- shipment inspection, hazard analysis critical control point (HACCP), international marketing channels, international prices (f.o.b and c.i.f), export risk insurance, market intelligence in international trade.

Practical

Visit to export units, regional export promotion council and APEDA; collection of exports, imports and prices data, analysis of data, EPC and NPC; Exim policy of the govt; group

profit versus wealth; agribusiness financial management, role of the financial manager, recording agribusiness transactions; accounting definition and meaning, users of accounting information, forms of business organization, the accounting equation; accounts, classification of commonly used accounts, the double entry system, recording transactions, journals and ledgers, trade balance, basic accounting considerations, assets and liabilities, capital and owners equity, revenue, cost of sales and net profit; operating and incidental expenses, inventory, depreciation, accounting cycle; income measurement, the adjustment process, preparing financial statements from the adjusted trade balance; preparing an income statement and balance sheet, profit and loss statements; financial ratio analysis, users of financial analysis, nature of financial ratios-types of ratios; financial planning, objectives of profit planning (or budgeting), essential of profit planning, types of budgets, preparation of profit plan or budgets.

Practical

Accounting equation, classification of accounts; double entry system, journals and ledgers, trail balance; preparing income statement and balance sheet; profit and loss statement, financial ratio analysis and few case studies.

AG ECON 405

**NATURAL RESOURCES ECONOMICS
AND MANAGEMENT**

**SEM VII/XI
3 (1+2)**

Theory

Natural resources and economic growth; resource scarcity and environmental degradation and their causes; optimum management of resources: land, water, forestry, fisheries, minerals etc.; markets in natural resources in agriculture; management of energy resources; allocation of natural resource over time; common property resources; investment decisions in relation to resource development; relationship between conservation, extraction and exploration of resources; economic efficiency and maximum social well being; social welfare function and criteria of economic policy.

Practical

Agriculture economy and environment: inter linkages, development of flow charts, classification of environmental problems in developing countries, data base and IT on environmental problems; working out different approaches to measure agricultural sustainability; methods of valuation of environmental costs and benefits and analyzing the benefit cost ratio of environmental and resource improvement projects; taxes, subsidies and markets-inter relations, discussing and analyzing the rural energy problems, food and energy nexus and rural ecosystems; study of legislative issues, treaties, conventions on natural resource and environmental management.

AG ECON 406

**AGRICULTURAL PROJECT
FORMULATION, EVALUATION AND
MONITORING**

**SEM VII/XI
3 (1+2)**

Theory

Project: meaning, project development, need and scope for project development in agriculture and rural development; role of NABARD in project development, management and implementation; project cycle: various steps involved in project management, development of projects related to agriculture and rural development; project appraisal techniques, discounting technique, computation of internal rate of return (IRR); monitoring the projects: various techniques like programme evaluation review technique (PERT), critical path method (CPM)

etc.; difference between monitoring and evaluation; project evaluation: approaches pre-post, ex-ante and ex-post, with and without - situations and justification, preparation and report writing.

Practical

Identification of agro based projects; preparation of balance sheet, income/profit-loss and cash flow statements; study of different financial ratios; visit to micro finance institute (MFI); preparation of agricultural and rural development projects; application of project evaluation techniques, presentation of projects prepared and report writing.

Practical

Visit to agromet observatory; working with thermometers, thermister, infrared thermometer, hygrometer, psychrometer, anemometer, pyranometer, albedometer, net radiometer, quantum sensor and lysimeter; agromet data base management; computation of radiation indices; computation of thermal indices; measurement and drawing of temperature and humidity profile in crops; computation of evapotranspiration using empirical methods.

**AGM 402/
SOILS 401**

**REMOTE SENSING, GIS AND LAND
USE PLANNING**

**SEM VII/XI
3 (1+2)**

**(To be taught jointly by Agricultural
Meteorology and Soil Science)**

Theory

Geographic co-ordinate system; map as a geographic model; types of maps and map reading; basic concepts of remote sensing and GIS; geographical feature abstraction; geographic information- data, features and maps; concept of raster and vector data; land use planning: concept, techniques and factors governing present land use; land evaluation methods and soil suitability evaluation for different crops; land capability classification and constraints in application.

Practical

Use of aerial photographs, RS imagery, toposheets and other maps; ground truth study using GPS and visual markings; supervised and unsupervised classification of digital image; digitization of maps; composing maps; use of arc catalogue, arc map, arc editor in GIS registration; geo-referencing of images and maps, editing of attribute tables, field survey, overlay, network, proximity and spatial analysis; soil survey of project area: analysis of soil characteristics and soil classification, preparation of erosion risk assessment maps and report writing.

AGRONOMY

Course No	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
AGRON 101	Introductory Agriculture	1 (1+0)	I/V
AGRON 102	Principles of Agronomy	3 (2+1)	II/VI
AGRON 103	Agriculture for Engineers (To be taught jointly by Agronomy, Horticulture and Soil Science) (For B.Tech. Agricultural Engineering)	4(3+1)	II
AGRON 201	Irrigation Water Management	3 (2+1)	III/VII
AGRON 202	Field Crops - I (<i>Kharif</i> Crops)	3 (2+1)	III/VII
AGRON 203	Field Crops - II (<i>Rabi</i> Crops)	3 (2+1)	IV/VIII
AGRON 204	Weed Management	2 (1+1)	IV/VIII
AGRON 205/ HORT 202/ VSC 202	Production Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Agronomy, Horticulture and Vegetable Science)	2 (1+1)	IV/VIII
AGRON 206	Crop Production (For B. Sc. (Hons.) Home Science)	2 (1+1)	IV/VIII
AGRON 301	Rainfed Agriculture	2 (1+1)	V/IX
AGRON 302	Organic Farming	2 (1+1)	V/IX
AGRON 303	Practical Crop Production - I (<i>Kharif</i> crops)	1 (0+1)	V/IX
AGRON 304	Practical Crop Production - II (<i>Rabi</i> crops)	1 (0+1)	VI/X
AGRON 305	Farming Systems and Sustainable Agriculture	2 (1+1)	VI/X
	Total Credits	31 (18+13)	
Elective Courses/Experiential Learning			
AGRON 401	Crop Management	3 (1+2)	VII/XI
AGRON 402	Water Management	3 (1+2)	VII/XI
AGRON 403	Integrated Farming Systems	2 (1+1)	VII/XI
AGRON 404	Commercial Production of Medicinal and Aromatic Plants	2 (1+1)	VII/XI
AGRON 405	Chemical Weed Control	2(1+1)	VII/XI
	Total Credits	12 (5+7)	
Rural Agricultural Work Experience (RAWEx)			
AGRON 491	Rural Agricultural Work Experience (To be conducted jointly by Agricultural Economics, Agronomy and Extension Education)	20 (10 Credit and 10 Non Credit)	VIII/XII
	Total Credits	20	

AGRON 101**INTRODUCTORY AGRICULTURE****SEM I/V****1 (1+0)****Theory**

Art, science and business of crop production; basic elements of crop production; factors affecting crop production; history of agricultural development; ancient India agriculture in civilization era; chronological agricultural technology development in India; Indian agriculture: balance sheet, liabilities, assets and contrasting trends (DAT); agricultural growth, contrasting food chain, diversity in physiography, soil groups, marine, livestock and water; liabilities: soil factors, weather factors, economic ecology, dry and irrigated agriculture, farming system approach, value addition, requirements in new technology; women in agriculture: multifaceted roles and tasks, work stress factors, nutritional and rural life standards, role of house hold design making, drudgery reduction for farm women, women friendly agricultural technology; empowerment of women: group dynamics for farm women, rural women; the nucleus of agricultural extension and training. Visit to NAS Museum, New Delhi.

AGRON 102**PRINCIPLES OF AGRONOMY****SEM II/VI****3 (2+1)****Theory**

Meaning and scope of agriculture; development of agriculture in India in general and Haryana in particular; national and international agricultural research institutes in India; agronomy: definition, history and its relation with other sciences; classification of crops: agronomic, seasonal, life span, botanical, seed size, root depth and water requirement etc; characteristics of good seed, types of seed and seed multiplication; crop growth, yield and factors affecting them; agronomic principles involved in crop production; tillage and its objectives, soil tilth and its optimum requirement for important crops; soil fertility, productivity and their maintenance; time and method of application of manures and fertilizers, cropping pattern(s), cropping systems and farming systems.

Practical

Study of tillage implements; practice of ploughing; practice of puddling; study of seeding equipments; different methods of sowing; study of intercultivation implements and practice; participation in ongoing field operations; identification of crops, weeds and their seeds; seed testing for purity, germination and moisture of various crop seeds; calculation of seed rate of different crops; preparation of seedarium; practice of methods of fertilizer applications; identification of fertilizers and manures, nutrient content of different fertilizers and manures; computing fertilizer and manurial requirement of various field crops; estimation of yield of different field crops.

AGRON 103**AGRICULTURE FOR ENGINEERS****SEM II/-****4 (3+1)****(To be taught jointly by Agronomy, Horticulture and Soil Science)****(For B.Tech. Agricultural Engineering)****Theory**

Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, classification of soils – soil taxonomy orders; important soil physical properties and their importance; soil particle distribution; soil

inorganic colloids: their composition and properties and origin of charge; ion exchange in soil and nutrient availability; soil organic matter – its composition and decomposition, effect on soil fertility; soil reaction: acid, saline and sodic soils; quality parameters of irrigation water and their determination; essential plant nutrients: their functions and deficiency symptoms in plants; important chemical fertilizers, their composition and reactions in soils; definition and scope of agronomy, classification of crops, effect of different weather parameters on crop growth and development, soil water plant relationship, weeds and their control, crop rotation, cropping systems, relay cropping, mixed cropping, intercropping operations; scope of horticulture and vegetable crops, soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, criteria for site selection, layout and planting methods, nursery raising, macro and micro propagation methods, plant growing structures, pruning and training, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices, garden tools, management of orchard, extraction and storage of vegetable seeds.

Practical

Identification of rocks and minerals; identification of chemical fertilizers; examination of soil profile in the field; determination of soil texture, bulk density; particle density, pH, EC, porosity of soil and organic carbon of soil; identification of crops and their varieties, seeds and weeds; fertilizer application methods; different weed control methods; judging maturity time for harvesting of crop; study of seed viability and germination test; identification and description of important fruit; flowers and vegetables crops; study of different garden tools, preparation of nursery bed; practices of pruning and training in some important fruit crops.

AGRON 201

IRRIGATION WATER MANAGEMENT

SEM III/VII

3 (2+1)

Theory

Importance and role of water in crop production; irrigation: definition, source of irrigation, water resources and irrigation development in India and Haryana; forms of soil moisture and their importance in crop production; soil plant water relationship; energy concept of plant water relations; components of water potentials; method of soil moisture estimation, evapotranspiration, crop water requirement and effective rainfall; scheduling and methods of irrigation; irrigation efficiency and water use efficiency and factors affecting them; conjunctive use of water; irrigation water quality and its management; water management of various field crops; drainage and methods of drainage, prevention of water losses and adverse effect of water logging; water stress and its effect on crop growth; irrigation strategies under limited water conditions; micro/pressure irrigation: sprinkler, mini-sprinklers, micro-sprinkler, drip irrigation and rain gun.

Practical

Determination of bulk density by field method; determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; soil moisture meter; determination of field capacity by field method; determination of permanent wilting point; measurement of irrigation water through flumes, weirs and flow meters; calculation of irrigation water requirement; determination of infiltration rate; demonstration and calculation of irrigation efficiencies of various methods of irrigation (flooding, boarder, furrow, check basin FIRBS, various types of drip and sprinkler systems etc); visit to farmers' fields, cost estimation and working of drip irrigation system and various types of sprinkler systems.

AGRON 202

FIELD CROPS - I (KHARIF CROPS)

SEM III/VII

3 (2+1)

Theory

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, manuring, water management, important limiting factors and constraints in crop production and cultivation of *kharif* crops; cereals: rice, maize, sorghum, pearl millet; pulses: pigeonpea, green gram and black gram, urdbean; oilseeds: groundnut, sesamum, soybean; fibre crops: cotton; and forage crops: sorghum, cowpea and napier.

Practical

Identification of different *kharif* crops and their seeds; morphological characters of major *kharif* crops; seed bed preparation and sowing of *kharif* crops; calculation of seed rate and the effect of seed size on germination and seedling vigour of *kharif* crops; preparation of *kharif* plant herbarium; effect of sowing depth on germination, manurial requirement and methods of fertilizer application; study of yield attributing characters, yield calculations, harvesting and yield estimation of *kharif* crops; study of crops, varieties and important agronomic experiments; visit to research stations.

AGRON 203

FIELD CROPS - II (RABI CROPS)

SEM IV/VIII

3 (2+1)

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices, manuring, water management, important limiting factors and constraints in production and cultivation of *rabi* crops; cereals: wheat, barley; pulses: chickpea, lentil, peas, frenchbean; oilseeds: rapeseed and mustard, and sunflower; sugar crops: sugarcane; commercial crops: tobacco; forage crops: berseem, lucerne and oat.

Practical

Seed bed preparation and sowing of different rabi season crops; preparation of rabi crops herbarium; calculations on seed rate, methods of fertilizer application; identification of *rabi* season crops and their seeds; morphological characteristics of wheat, barley, mustard, *rabi* pulses; yield contributing characters of *rabi* crops; visit to research stations.

AGRON 204

WEED MANAGEMENT

SEM IV/VIII

2 (1+1)

Theory

Weeds: introduction, harmful and beneficial effects, classification, propagation and dissemination; weed biology and ecology; crop weed association; crop weed competition and allelopathy; concepts of weed prevention, control and eradication; methods of weed control: physical, cultural, chemical and biological; integrated weed management; herbicides: advantages and limitations of herbicides uses in India; herbicide classification, formulations, method of application; introduction to adjuvants and their uses in herbicides; introduction to selectivity of herbicides; compatibility of herbicides with other agro-chemicals; weed management in major field and horticultural crops; shift of weed flora in cropping systems, aquatic and problematic weeds and their control.

AGRON 301

RAINFED AGRICULTURE

SEM V/IX

2 (1+1)

Theory

Rainfed farming: introduction; climatic and edaphic characteristics of rainfed agriculture; distribution of low rainfall areas in the state/india; problems of crop production in rainfed farming; land shaping and planting methods under low rainfall conditions; efficient management of rainfed crops; critical stages of life saving irrigations; major constraints and special package of practices for *kharif* and *rabi* crops under dryland conditions of haryana; study of mulches and anti-transpirants; water harvesting and moisture conservation; principles of intercropping, cropping systems/intercropping in rainfed agriculture; choice of crops and varieties for rainfed crops; contingent crop planting for aberrant weather situations; watershed management: principals and practices; scope of agro-horticultural, agro-forestry and silvi-pasture in dryland agriculture.

Practical

Rainfall analysis and interpretation, study of dry farming implements; agronomic measures of soil and moisture conservation; water conservation through different types of mulches and anti-transpirants, collection of biometric data of crops and its interpretation.

AGRON 302

ORGANIC FARMING

SEM V/IX

2 (1+1)

Theory

Organic Farming: introduction, concepts, relevance in present context; organic production requirements; biological intensive nutrient management-organic manures, vermi-composting, green manuring, recycling of organic residues, bio-fertilizers; soil improvement and amendments; integrated diseases and pest management use of bio-control agents, bio-pesticides pheromones, trap crops, bird perches; water and weed management; quality considerations, certification, labeling and accreditation, marketing, exports.

Practical

Study of organically grown field crops through nutrient, diseases and pest management; vermi-composting; macro quality analysis, grading, packaging and post harvest management; quality of various composts made from different raw materials; green manure.

AGRON 303

**PRACTICAL CROP PRODUCTION – I
(KHARIF CROPS)**

SEM V/IX

1 (0+1)

Practical

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

AGRON 304

**PRACTICAL CROP PRODUCTION-II
(RABI CROPS)**

**SEM VI/X
1 (0+1)**

Practical

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

AGRON 305

**FARMING SYSTEMS AND
SUSTAINABLE AGRICULTURE**

**SEM VI/X
2 (1+1)**

Theory

Sustainable agriculture: introduction, definition, goal and current concepts; land degradation and conservation of natural resources, LEIA and HEIA; waste land and their development; organic farming: definition principle and components; farming systems: definition, principles and components; IFS models for wet land, irrigated dryland and dryland situations; problems and prospects of present day agriculture.

Practical

Preparation of cropping systems for irrigated and dryland situations; study of existing farming systems in nearby villages; preparation of integrated farming systems, model for wet lands; preparation of integrated farming systems model for drylands; preparation of enriched farm yard manure; preparation of vermi-compost; visit to urban waste recycling unit; study of profitable utilization of agricultural wastes; visit to poultry and dairy units to study resource allocation, utilization and economics; visits to organic farm to study various components and utilization; study of degraded lands.

AGRON 401

CROP MANAGEMENT

**SEM VII/XI
3 (1+2)**

Theory

Factors affecting crop growth and yield; management of environment for crop production; tillage, tillth and modern concepts of tillage; tillage implements and their use under different soil and crop conditions; selection of crops and cultivars for different agro-climatic conditions; optimum time of sowing, seed rate, crop spacing and method of sowing for higher crop yield; factors influencing crop response to fertilizers; integrated nutrient management, balanced fertilization; principles of harvesting, storage and post harvest management.

Practical

Study of crop responses to various agronomic practices, comparative economics of different crops and cropping systems; crop planning and layout for different agro-climatic situations; seedbed preparation for different crops with different tillage implements; demonstration of different methods of sowing; calibration of seed drill for different crops sowing; field layout of different methods of sowing; demonstration of different methods of fertilizer application; computing resource use and plant interaction indices and productivity efficiency for evaluating different crops under different levels of input and planting methods; visit to different agro-climatic zones of the state to study the various constraints of crop production.

Theory

Watershed concepts, objectives of watershed management, delineation of watershed, inventory of natural resources in watershed; soil erosion, types of erosion and erosion resistant and erosion permitting crops, contour bunds, graded bunds, terracing, water harvesting structures; recycling of run off water- protective and supplemental irrigations; agronomic measures- suitable cropping systems, conservation tillage technique – in-situ conservations measures; micro irrigation: introduction, scope, different types of micro-irrigation systems, conventional surface and micro irrigation systems, principles, advantages, limitations and adaptability to crops; soil water availability, irrigation frequency, irrigation scheduling in micro irrigated crops; Wetting pattern and wetted area under sprinklers and emitters; fertigation - water soluble fertilizers; speciality fertilizers, components of micro irrigation system, design, installation of systems, operation and maintenance of systems fertigation equipments, uniformity co-efficient, monitoring and evaluation of these systems; problematic water –quality of water, classification of water, management of saline, sodic and sewage water, crop responses to problems waters, conjunctive use of water.

Practical

Study of agronomic measures of soil and moisture conservation, evaluation of treatment effect on moisture conservation, analysis of rainfall, estimation of run off, study and design of conservation structures- contour bunds, study and design of graded bunds and terrace system, study of water harvesting structures, visit to Bunga watershed, visit to Balawas watershed, study of different components of sprinkler irrigation, study of layout of sprinkler irrigation, field determination of distribution pattern and uniformity co-efficient of sprinkler system, study the operation and maintenance of sprinkler system, study of different components of drip irrigation, layout of drip irrigation, operation and maintenance of drip system, calculation of application rate, field study of wetting patterns under an emitter in different soil types, fertigation through sprinkler and drip system of irrigation, calculation of fertilizer requirement for fertigation, assessment and interpretation of water quality data for use in irrigation, analysis of water for EC, pH, RSC; study of economics of micro irrigation, field visit to study the operation of sewage irrigation systems.

Theory

Farming system: definition, scope and characteristics, classification, historical development of F.S's in india under different situations; concepts and components of farming system, interaction between components; cropping system, complementary and competitive interaction; effect of preceding crops and associated crops; indices for evaluation for cropping system; agronomic requirements in management of cropping system; sustainable agriculture, role of farming systems in sustainable agriculture, integrated farming systems, factors governing choice and size of enterprises and resources allocation in integrated farming system; models of integrated farming systems for irrigated ecosystems and rainfed ecosystems; importance and role of IFS's in organic farming, low input sustainable agriculture and low cost agricultural technologies.

watershed management; high-tech agriculture; natural resource management in different cropping systems and agro-climatic zones of the state; techno-economic survey: documentation of information through survey and discussion with farmers, preparation of farm plans and family budget, information on bank loans for agro-projects; implications of WTO; Extension Education Programmes: study of programmes and activities of various agricultural developments, extension agencies and institutes; interactions with the farmers and communication skills for effective extension methods; agro-industrial attachment (5 weeks): training on working of agro based industries such as post harvest technology; agro-processing; quality control, to know current problems of agro based industries; self employment training (SET) (2 weeks): crop production, seed production and testing, soil and water testing, fruit and vegetable technology and nursery management, commercial bee keeping, repair and maintenance of plant protection equipments, mushroom production technology, plant clinic, operation, repair and service of farm machinery, diesel engines, pumping sets and electric motors, dairy and poultry farming, farm forestry and agricultural meteorology etc; project report preparation (2 weeks): preparation of report on rural experience gained, agro-industrial training attained, self employment training received, programmes and activities of various institutions visited, major constraints in crop production and suggestions for improving income of farmers; presentation and evaluation of report (1 week): presentation and submission of report by interns, viva- voce and evaluation on the basis of viva-voce and reports, punctuality, enthusiasm, conduct, leadership qualities, sincerity and devotion displayed by the interns.

ENTOMOLOGY

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
ENT 101	Insect Morphology and Systematics	4 (3+1)	II/VI
ENT 201	Insect Ecology and Integrated Pest Management including Beneficial Insects	3 (2+1)	IV/VIII
ENT 202/ NEMA 201/ PL PATH 203	Plant Protection (To be taught jointly by Entomology, Plant Pathology and Nematology - 40: 40:20) (For B. Sc. (Hons.) Home Science)	2 (0+2)	VI/X
ENT 301	Crop and Stored Grain Pests and their Management	3 (2+1)	V/IX
	Total Credits	12 (7+5)	
Elective Courses/Experiential Learning			
ENT 401	Integrated Pest and Disease Management (To be taught jointly by Entomology, Nematology and Plant Pathology)	4(2+2)	VII/XI
ENT 402	Management of Non-Insect and Storage Pests	2(1+1)	VII/XI
ENT 403	Apiculture	2(0+2)	VII/XI
ENT 404	Bio-Control Agents and Bio-Pesticides (To be taught jointly by Entomology, Nematology and Plant Pathology)	3(1+2)	VII/XI
ENT 405	Pesticides and Plant Protection Equipment (To be taught jointly by Entomology and Plant Pathology)	2(1+1)	VII/XI
	Total Credits	13 (5+8)	

ENT 101

**INSECT MORPHOLOGY AND
SYSTEMATICS**

**SEM II/VI
4 (3+1)**

Theory

History of entomology in India; factors for insect abundance; classification of phylum arthropoda upto classes; relationship of class insecta with other classes.

Morphology: structure and functions of insect cuticle and moulting; body segmentation; structure and modifications of insect antennae, mouth parts and legs; wing venation, modifications and wing coupling apparatus; sensory organs; metamorphosis and diapause in insects; types of larvae and pupae; structure and functions of digestive, circulatory, excretory, respiratory, nervous and reproductive systems in insects; types of reproduction in insects.

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; important orders and their families: Orthoptera (Acrididae, Tettigoniidae, Gryllidae, Gryllotalpidae, Schizodactylidae); Dictyoptera (Mantidae,

Blattidae); Odonata; Isoptera (Termitidae); Thysanoptera (Thripidae); Hemiptera Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Lophopidae, Lacciferidae); Neuroptera (Chrysopidae); Lepidoptera (Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Pieridae, Danaidae, Papilionidae, Yponomeutidae (Plutellidae), Hesperidae, Sphingidae, Bombycidae); Coleoptera (Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Dermestidae, Tenebrionidae, Meloidae, Bostrychidae, Lampyridae); Hymenoptera (Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Encyrtidae, Aphelinidae, Eulophidae); Diptera (Cecidomyiidae, Trypetidae, Tachinidae, Agromyzidae, Tephritidae, Syrphidae, Muscidae, Glossinidae, Asilidae, Tabanidae).

Practical

Methods of collection and preservation of insects including immature stages; external features of grasshopper/blister beetle; types of insect antennae, mouthparts and legs; wing venation, types of wings and wing coupling apparatus; types of insect larvae and pupae; dissection of digestive system in insects; dissection of male and female reproductive systems in insects; study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families.

Note: Students should submit at least 75-100 dried well mounted insect specimens representing different orders and families before the practical examination.

ENT 201

**INSECT ECOLOGY AND INTEGRATED
PEST MANAGEMENT INCLUDING
BENEFICIAL INSECTS**

**SEM IV/VIII
3 (2+1)**

Theory

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; concepts of balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem; pest surveillance and pest forecasting; categories of pests.

Integrated Pest Management (IPM): introduction, importance, concepts and tools of IPM - host plant resistance, cultural, mechanical, physical, legislative, biological (parasites, predators and pathogens such as bacteria, fungi and viruses) methods of control; chemical control: importance, hazards and limitations; classification of insecticides, toxicity of insecticides and formulations of insecticides; study of important insecticides; recent methods of pest control: repellents, antifeedants, hormones, attractants, gamma radiation and genetic control; scope and limitations of IPM; insecticide Act 1968: important provisions; application techniques of spray fluids; phytotoxicity of insecticides; symptoms of poisoning, first aid and antidotes; beneficial insects parasites and predators used in pest control and their mass multiplication techniques; important groups of microorganisms: bacteria, viruses and fungi used in pest control and their mass multiplication techniques; important species of pollinators, weed killers and scavengers: their importance; non-insect pests: mites, nematodes, rodents and birds; silk worms, honey bees and lac insects.

Practical

Visit to meteorological observatory/automatic weather reporting station; study of terrestrial and pond ecosystems of insects; studies on behaviour of insects and orientation (repellency, stimulation, deterancy); study of distribution patterns of insects, sampling techniques for the estimation of insect population and damage; pest surveillance through light traps, pheromone traps and field incidence; practicable IPM practices: mechanical and physical methods, cultural and biological methods; chemical control: insecticides and their formulations; calculation of doses/concentrations of insecticides; compatibility of pesticides and phytotoxicity of insecticides; IPM case studies; identification and mass multiplication of important natural enemies; identification and management of honeybees; identification of rodents and bird pests and their damage; other beneficial insects: pollinators, weed killers and scavengers.

**ENT 202/
NEMA 201/
PL PATH 203**

PLANT PROTECTION

**SEM VI/X
2 (0+2)**

**(To be taught jointly by Entomology, Plant Pathology and Nematology-40: 40:20)
(For B.Sc. (Hons.) Home Science)**

Practical

Familiarization, identification, nature of damage and management of important insect pests of wheat, rice, cotton, chickpea, sugarcane, horticultural crops, stored grain pests, household pests; methods of pest control: physical, mechanical, cultural and chemical; bio-pesticides; integrated pest management; familiarization with insecticides and their identification, formulation and safe use of pesticides; plant diseases: symptoms and etiology- fungi, prokaryotes, viruses and viroids; symptoms and management of important plant diseases of wheat, rice, cotton, chickpea, sugarcane and horticultural crops; plant protection equipments; fungicides, their formulations and uses; nematodes: familiarization, nature of damage and symptoms of damage in wheat, rice, cotton and horticultural crops.

ENT 301

CROP AND STORED GRAIN PESTS AND THEIR MANAGEMENT

**SEM V/IX
3 (2+1)**

Theory

Distribution, biology, nature and symptoms of damage and management strategies of insect and non-insect pests of rice, sorghum, maize, wheat, sugarcane, cotton, sunhemp, pulses, groundnut, castor, safflower, sunflower, mustard, brinjal, bhindi, tomato, cruciferous and cucurbitaceous vegetables, potato, chillies, mango, citrus, grapevine, cashew, banana, pomegranate, guava, sapota, ber, apple, coconut, tobacco, coffee, tea, turmeric, onion, garlic coriander, pepper, ginger and ornamental plants; stored grain pests: coleopteran and lepidopteran pests, their biology and damage, preventive and curative methods.

Practical

Identification of pests and their damage symptoms on rice, sorghum, maize, wheat, sugarcane, cotton, pulse crops, solanaceous and malvaceous vegetables, cruciferous and cucurbitaceous vegetables, chillies, mango, ber, citrus, sapota, grapevine, guava and pomegranate.

ENT 401

**INTEGRATED PEST AND DISEASE
MANAGEMENT**

SEM VII/XI

4 (2+2)

(To be taught jointly by the Departments of Entomology and Plant Pathology)

Theory

Integrated Pest Management (IPM): history, definition and concept; concept of economic injury level and economic threshold, pest monitoring and surveillance; different tools of IPM including physical, mechanical, cultural, biological, host plant resistance, botanical, chemical, biorationals and biotechnological approaches; integration of different IPM tactics; decision making systems; potential of IPM, its implementation and constraints; successful examples in IPM; Integrated Disease Management (IDM): concept, advantage and importance, components of IDM their limitations and implications; development of IDM - basic principles, IDM application and implementation in some important crops; cost benefit and risk benefit ratio.

Practical

Demonstration of pest management practices; use of pheromone, colour, sticky and light traps for monitoring and surveillance of pests; study of IPM module in cotton, rice, sugarcane, maize, fruits and vegetables; application of cultural, chemical and bio-control agents, their compatibility and integration in IDM, demonstration of IDM in some crops as project work.

ENT 402

**MANAGEMENT OF NON-INSECT AND
STORAGE PESTS**

SEM VII/XI

2 (1+1)

Theory

Distribution, host range, biology, population dynamics and pattern of damage of agriculturally important rodents and other mammals, birds, mites, slugs and snails; management strategies: physical (trapping, acoustic and visual) and chemical (poisons, repellents, fumigants and anticoagulants); historical development of storage entomology; important pests associated with stored grains, their systematic position, identification, distribution, host range, biology, ecology, nature and extent of damage, and their management.

Practical

Identification of important rodents, birds, mites and other pests; damage assessment, population estimation and control operations of different pests; collection, identification and familiarization with the stored grain pests and damage caused by them; demonstration of fumigation technique.

ENT 403

APICULTURE

SEM VII/XI

2 (0+2)

Practical

Important species of honey bees, caste differentiation and body structure; handling of colonies; bee flora; seasonal management practices; colony division; mass rearing techniques for queen bee; queen introduction, clipping and marking; bee pollination of crops; management of bacterial, viral and fungal diseases of honey bees; identification and management of parasitic mites, wax moths, ants and wasps, and predatory birds; honey extraction; pollen, propolis and bee venom collection; processing of bee wax; royal jelly

EXTENSION EDUCATION

Course No.̀	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
EXT 201	Dimensions of Agricultural Extension	3 (2+1)	IV/VIII
EXT 301	Extension Methodologies for Transfer of Agricultural Technology	3 (2+1)	VI/X
EXT 302	Entrepreneurship Development and Communication Skills	2 (1+1)	VI/X
	Total Credits	8 (5+3)	
Elective Courses/Experiential Learning			
EXT 401	Extension Approaches for Agricultural Development	3 (1+2)	VII/XI
EXT 402	Agricultural Journalism	3 (1+2)	VII/XI
EXT 403	Visual and Graphic Communication	2 (1+1)	VII/XI
EXT 404	Information Communication Technology in Agriculture	3 (1+2)	VII/XI
EXT 405	Principles of Management and Group Dynamics	3 (2+1)	VII/XI
	Total Credits	14 (6+8)	

EXT 201

**DIMENSIONS OF AGRICULTURAL
EXTENSION**

**SEM IV/VIII
3 (2+1)**

Theory

Education: meaning, definition, types-formal and non-formal education and their characteristics; extension education and agricultural extension: meaning, definition; concepts, objectives and principles; rural development: meaning, definition, concepts, objectives, importance and problems in rural development; developmental programmes of pre-independence era: Shriniketan, Marthandam, Gurgaon experiment and Gandhian constructive programme; development programmes of post independence era, Firka development, Etawah pilot project and Nilokheri experiment; community development programme: meaning, definition, concepts, philosophy, principles, objectives, differences between community development and extension education; national extension service; panchayat raj system: meaning of democratic-decentralization and panchayat raj, three tiers of panchayat raj system, powers, functions and organizational setup; agricultural development programmes with reference to year of start, objectives and salient features: Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP), ATMA, ATIC; social justice and poverty alleviation programmes: Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jayanthi Gram Swarajgar Yojana (SGSY), Prime Minister Employment Yojana (PMEY); new trends in extension, privatization in extension; women development programmes: Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS) and Mahila Samridhi Yojana (MSY), reorganized extension system (T and V System): salient features, fortnight meetings, monthly workshops, linkages, merits and demerits, emergence of broad based extension.

Practical

Visits to a village and kisan mandal to study the ongoing development programmes; visits to Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP) and Zila Parishad (ZP); visit and study the District Rural Development Agency (DRDA); participation in monthly workshops of Training and Visit (T and V) system; visit to watershed development project area; visit to a village to study the Self Help Groups (SHGs) of DWCRA; visit to a voluntary organization to study the developmental activities; organizing PRA techniques in a village to identify the agricultural problems; visit to villages.

EXT 301

EXTENSION METHODOLOGIES FOR TRANSFER OF AGRICULTURAL TECHNOLOGY

**SEM VI/X
3 (2+1)**

Theory

Communication: meaning, definition, models, elements and their characteristics, types and barriers in communication; extension programme planning: meaning, definitions of planning, programme, project, importance, principles and steps in programme development process, monitoring and evaluation of extension programmes; extension teaching methods: meaning, definition, functions and classification; individual contact methods: farm and home visit, result demonstration, field trials: meaning, objectives, steps, merits and demerits; group contact methods: group discussion, method demonstration, field trips: meaning, objectives, steps, merits and demerits; small group discussion techniques: lecture, symposium, panel, debate; forum, buzz group, workshop, brain storming, seminar and conference; mass contact methods: campaign, exhibition, kisan mela, radio and television: meaning, importance, steps, merits and demerits; factors influencing in selection of extension teaching methods and combination (media mix) of teaching methods; innovative information sources: internet, cyber cafes, video and tele conferences, kisan call centers, consultancy clinics; agricultural journalism: meaning, scope and importance, sources of news, types, merits and limitations; diffusion and adoption of innovations: meaning, definition, models of adoption process, innovation decision process: elements, adopter categories and their characteristics, factors influencing adoption process; capacity building of extension personnel and farmers: meaning, definition; types of training, training to farmers, farm women and rural youth – FTC and KVK.

Practical

Simulated exercises on communication; identifying the problems, fixing the priorities and selecting a most important problem for preparation of a project; developing a project based on identified problems in a selected village; organization of group discussion and method demonstration; visit to KVK/FTC; planning and writing of scripts for radio and television; audio visual aids: selection, planning, preparation, evaluation and presentation of visual aids; planning and preparation of visual aids: charts, posters, over head projector, (OHP), transparencies, power point slides; planning and preparation of agricultural information materials: leaflet, folder, pamphlet, news stories, success stories, handling of public address equipment (PAE) system, still camera, video camera and liquid crystal display (LCD) projector.

EXT 302

**ENTREPRENEURSHIP DEVELOPMENT
AND COMMUNICATION SKILLS**

**SEM VI/X
2 (1+1)**

Theory

Entrepreneurship development: concept of entrepreneurship, entrepreneurial and managerial characteristics, managing an enterprise, motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programmes; government schemes and incentives for promotion of entrepreneurship; government policy on small and medium enterprises (SMEs)/SSIs; export policies relevant to agriculture sector; contract farming, public-private partnership; overview of agri inputs industry; characteristics of Indian agricultural processing and export industry; communication skills: meaning and process of communication: verbal and non-verbal communication; listening, note taking, writing skills, oral presentation skills and fidelity of communication.

Practical

Oral presentation skills; reading and comprehension of general and technical articles; preparation of business plan, visit to an entrepreneurial unit.

EXT 401

**EXTENSION APPROACHES FOR
AGRICULTURAL DEVELOPMENT**

**SEM VII/XI
3 (1+2)**

Theory

Participatory extension approaches RRA, PRA and PLA: meaning, features, principles, techniques; demand driven extension: meaning, features, model; reorganized extension system; broad based extension: meaning, concept; farmer led extension: meaning, features, scope and importance; farming systems approach and farming situation based extension: concept, characters, activities and scope; strategic research and extension plan: meaning and importance; group led extension: meaning, concepts, procedures, advantages and limitations; market led extension: meaning, problems in agricultural marketing, characteristics, approaches and strategies; privatization of agriculture extension services and public private partnership: meaning, problems in public extension, reasons for privatization, approaches, possibilities; voluntary organizations in agricultural extension-scope and importance, limitations.

Practical

Analyzing the roles of change agents in state department of agriculture; visit to a village to observe the extension activities at the field level; visit to a ATMA district; identification of technological needs of farmers through participatory approach; identification of suitable alternative extension approaches for solving extension problems in a specific farming situation; preparation of research and extension plan using PRA, FSR/E and FSBE; analyzing the functions of a selected; V.O. studying role of farm women and rural youth in agriculture in a selected village; studying RMGS and SHGS in a selected village.

EXT 402

AGRICULTURAL JOURNALISM

**SEM VII/XI
3 (1+2)**

Theory

Journalism: meaning, nature, scope and importance; agricultural journalism: meaning, concept, nature, history, scope and importance; journalist: meaning, roles, qualities, types;

print media: concept, role, trends, principles, laws, ethics; readership analysis: meaning, importance, methods; writing new stories, feature articles and success stories: planning and writing; agricultural information materials: planning, preparation and evaluation of information materials – leaflet, pamphlet, folder, bulletin; electronic media: concept, types, trends, principles, ethics; listeners/viewers analysis: meaning, importance, methods; report writing: gathering of news, forms of reporting, principles for creative writing, editing and proof reading; radio: scope and importance, script writing for radio, treatment, recording and broad casting; television: scope and importance, script writing for TV, planning, recording and telecasting; photo journalism: concept, scope and importance, principles, selection and editing of photographs, writing photo features and captions; video production technology: concepts, types of cameras and parts, different formats, techniques of planning, production and editing, types of shots, audio and video mixing; public relations: meaning, concept, scope and dimensions, scenario in organizations.

Practical

Designing of layout and preparation of agricultural information materials; testing the readability of prepared agricultural information materials; gathering of news by using different methods; exercise on writing of different forms of news reports in print media; editing process in print media; testing the readability of printed literature; visit to a newspaper office; visit to All India Radio Station/TV Studio; script writing for radio; rehearsal recording, editing and evaluation of radio program; preparation of story board for TV; method of holding and exposing a still camera; writing captions for photographs; writing photo features for photographs; studying various parts of video camera and handling of video camera; audio and video mixing.

EXT 403

**VISUAL AND GRAPHIC
COMMUNICATION**

**SEM VII/XI
2 (1+1)**

Theory

Meaning, definitions and the role of visuals in communication; characteristics of visual aids; classification of visual aids; principles and production of visuals; contribution of visual perception in learning process; planning, preparation, presentation and evaluation of visual aids; designing of messages and titles for visuals; layout of visual aids; selection and use of graphic formats; preparation and use of low cost visuals based on the local situation; preparation and use of photographs and pictures; reprographic visuals; computer based visuals and digitized video materials; use of drawing techniques for different visuals; selection and use of animation tools in transfer of technology; preparation and use of resource maps for extension work; designing of visuals for print and electronic media.

Practical

Preparation of low-cost visuals; designing and layout of visual aids; generating computer aided presentation of graphics; scanning of visuals; image editing and script writing for telecasts; development of agricultural video films; editing of video visuals; visit to animation production center; visit to print and electronic media centers; presentation and evaluation of low cost visual.

EXT 404

**INFORMATION COMMUNICATION
TECHNOLOGY IN AGRICULTURE**

**SEM VII/XI
3 (1+2)**

Theory

Multimedia: definition, scope and importance in agricultural development: important

concepts in multimedia technologies; computer in agriculture: cyber extension – definition, meaning, tools, advantages and limitations, successful models of cyber extension; introduction to basics in computers; MS power point, internet applications for multimedia: multimedia file formats –HTML, audio, photo, video and image file formats and file posting; computer assisted information basics: story boarding and application; multimedia databases, relational database model, distributed and networks model; audio-production editing, photo editing; animation tools and graphic tools; development of multimedia project: resource development, integration and presentation; web based presentation Vs CD presentation.

Practical

Basics in computer: MS office, MS power point and internet applications; CAI application and story board writing; CAI presentation, multimedia file formats; audio, photo and video production, editing and using the software; animation and graphic tools software; developing multimedia project using authoring tools; development of multimedia project and presentation; visit to kisan call centre / village information Kiosks.

EXT 405

PRINCIPLES OF MANAGEMENT AND GROUP DYNAMICS

**SEM VII/XI
3 (2+1)**

Theory

Meaning, concept and theories of management and organizational behaviour; organizational structure, types; hierarchy and span of control; motivation, job satisfaction, decision-making; programme evaluation and review technique (PERT); critical path management (CPM) and management by objectives (MBO); manpower planning, recruitment and selection; performance appraisal; rewards and incentive management; groups: meaning, characteristics, types of groups and process of group dynamics; group discussion, types, purpose and function of group leaders and members; group behaviour and factors influencing group behavior; problems of group integration, problems of prejudice and perception of other members; inter-group competition and preventing inter-group conflict; extension work with disadvantaged group; advertisement: theories, process, types, effectiveness and strategies.

Practical

Practice in various communication skills and group discussion techniques; analysis and appraisal of various types of advertisement media; organizing group; exercise in simulation and real life situation.

FORESTRY

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
FOR 301	Social and Farm Forestry	3 (2+1)	V/IX
FOR 302	Environmental Science (To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soil Science) (For B.Sc. (Hons.) Agriculture, B.Tech. (Agricultural Engineering) and B.Sc. (Hons.) Home Science)	2 (1+1) NC	VI/X
	Total Credits	5 (3+2)	
Elective Courses/Experiential Learning			
FOR 401	Nursery Technology for Commercial Forest Trees	3 (1+2)	VII/XI
FOR 402	Production Technology of Economic Forest Trees	4 (2+2)	VII/XI
	Total Credits	7 (3+4)	

FOR 301

SOCIAL AND FARM FORESTRY

**SEM V/IX
3 (2+1)**

Theory

Introduction: forests in india, forest influences, forest policy and law, gap between demand and supply of forest products; principles of general silviculture; social forestry: need, objectives and scope, choice of species for fuelwood, fodder, small timber and timber, their culture, propagation, application of agrotechniques and economic benefits, management of social forestry plantations, nurseries and their practices; afforestation on different problematic sites; voluntary organizations and their role in promoting afforestation programmes; maintenance and conservation of village woodlots; energy plantations; social forestry for watershed management; farm forestry: objectives and role, need for shelter belts and wind breaks, types of farm forestry; agroforestry: need, objectives, scope, principles and practices of agroforestry systems, choice of tree species, management implications; forest products, their processing and use.

Practical

Identification of tree species suitable for timber, fuel wood and fodder; identification of tree species suitable for road side plantations, field bunds, wastelands and for wind breaks; identification of fast growing, multipurpose and nitrogen fixing trees suitable for agroforestry; identification of seeds of important tree species in above categories; collection, extraction and storage of tree seeds; testing of tree seeds for viability and germination; application of pre-sowing seed treatments to problematic tree seeds; preparation of nursery beds and sowing; transplanting of nursery beds and sowing; field planting techniques; biomass and volume estimation in energy plantation; evaluation of different agroforestry systems during field visit; evaluation of wind breaks and shelter belts during field visit; identification of important major and minor forest products; visit to central nurseries of social forestry/forest departments; visit to social forestry plantations.

FOR 302

ENVIRONMENTAL SCIENCE

SEM VI/X

2 (1+1) NC

(To be taught jointly by Forestry, Entomology, Agricultural Economics, Agricultural Meteorology, Agronomy and Soil Science)

(For B.Sc. (Hons.) Agriculture, B.Tech. (Agricultural Engineering) and B.Sc. (Hons.) Home Science)

Theory

Scope and importance of environmental studies, natural resources: renewable and non renewable resources, forest, water, food, energy and land resources; ecosystems: definition, concept, structure and functions, producers, consumers and decomposers of an ecosystem; energy flow in the ecosystem and types of ecosystems; bio-diversity: definition, classification, threats of biodiversity and its conservation; global warming and role of plantation forestry in environment protection; awakening movements for tree protection; waste land development through tree plantation; agroforestry, farm forestry and social forestry plantations; environmental pollution: causes, effects and control of air, water, soil, thermal, noise and marine pollution; causes, effects and management of soil nuclear hazards and industrial wastes; disaster management: floods, earthquakes, cyclones and land slides; social issues and the environment, unsustainable to sustainable development; Acts: the environment protection Act, the air Act, the water Act, the wildlife protection Act and forest conservation Act; woman and child welfare, HIV/AIDS and role of information technology on environment and human health.

Practical

Identification of tree species; waste land development through tree plantations; agroforestry, farm forestry and social forestry plantations; collection, processing and storage of effluent samples; determination of bio-chemical oxygen demand (BOD) in effluent sample; determination of chemical oxygen demand (COD) in effluent sample; estimation of dissolved oxygen in effluent samples; determination of sound level by using sound level meter; estimation of respirable and non respirable dust in the air by using portable dust sampler; determination of total dissolved solids (TDS) in effluent samples; estimation of species abundance of plants; estimation of nitrate contamination in ground water; analysis of temporary and total hardness of water sample by titration; estimation of pesticide contamination in agro-ecosystem; visit to social service organizations/ environmental education centre; crop adaptation to environmental variables; soils conditions; study of transpiration and water balance in plants; visit to a local polluted site; observations and remedial measures; assessment of chlorophyll content of fresh water/sea water ecosystem.

FOR 401

**NURSERY TECHNOLOGY FOR
COMMERCIAL FOREST TREES**

SEM VII/XI

3 (1+2)

Theory

Flowering and seed production in gymnosperms and angiosperms; development and maturation of seed/ fruit; modes of seed dispersal; determining optimal harvest maturity indices; factors influencing choice of collection methods; seed production area and seed orchard, methods of seed collection and processing, stage methods and seed testing techniques; seed certification; introduction and importance of nursery; types of nurseries; bare root, containerized and vegetatively produced nursery; physiology and nursery environment interaction affecting seedling growth; root culturing techniques; lifting

windows, grading, packaging and storing and out planting.

Practical

Identification of forest seeds; seed sampling, different storage methods; seed quality testing-purity, viability and germination, collection and processing of seeds/ fruit; tests of viability viz., cutting, hydrogen peroxide, excised tetrozolum, embryo, seed health testing; introduction and identification of modern equipments and tools used in nursery; pre-sowing seed treatments; preparation of nursery beds and growing media for containerized nursery; sowing of seed and other intermediate nursery management operations; preparation and planting of cuttings; use of vegetative propagation methods such as budding, grafting and layering; precaution required in vegetative propagation, use of plant bio-regulators for rooting maintenance of nursery records; identification of nursery insects and diseased and their control measures; visit to nurseries; bare root nursery: nursery soil and water management, bed preparation, pre sowing seed treatments, seed sowing and intermediate operations viz., pricking, watering, fertilization, weeding and hoeing; containerized nursery: type and size of container including root trainers, selection of growing medium; types of green house and mist chamber for propagation; vegetative propagation: selection of superior phenotype, methods of propagation viz. cutting, budding, grafting and layering; factors affecting rooting of cuttings; structures, media fertilizers, sanitation and containers, source selection and management in vegetative propagation.

FOR 402

PRODUCTION TECHNOLOGY OF ECONOMIC FOREST TREES

**SEM VII/XI
4 (2+2)**

Theory

Role of plantation forestry in meeting the wood demand: plantation forestry in India and abroad, purpose of plantation, factors determining scale and rate of plantation, land suitability and choice of plantation species; production technology for quality planting stock, preliminary site preparation for establishing plantation, planting programme, time of planting, planting pattern, spacing, plating method; nutritional dynamics and irrigation of plantation, mechanization in plantation, protection and after care of plantation, pruning and thinning of plantation for quality wood production, rotation in plantation, failure of plantations, impact of interaction and integration of plantation forestry, protective afforestation, afforestation of inhospitable sites, ecological factors and long term productivity, sustainable yield from plantation; case studies in plantations of eucalyptus, casuarina, poplars, acacias, pine, sissou, teak, sandal, bamboo, mahaneem, etc. wasteland plantation, industrial plantation.

Practical

Analysis of plantation problems in Asia and India; preparation of plantation calendar, preliminary arrangement for a plantation programme, planting geometry and calculation of planting stock, study of different cultural operations and site preparation for plantation, studies on wood based industries, problems and prospects, management of *Eucalyptus tereticornis*, *Casuarina*, poplars, *Acacias*, Pine, sissou, teak, *Prosopis spp*, bamboo, mahaneem plantations, production technology for energy plantations, commercial plantations, irrigation and plantations, economics of pulpwood, timber and energy plantations.

GENETICS & PLANT BREEDING

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
GP 101	Fundamentals of Genetics	3 (2+1)	II/VI
GP 201	Principles of Plant Breeding	3 (2+1)	III/VII
GP 202	Breeding of Field Crops	3 (2+1)	IV/VIII
GP 301	Principles of Plant Biotechnology	3 (2+1)	V/IX
	Total Credits	12 (8+4)	
Elective Courses/Experiential Learning			
GP 401	Crop Improvement	3 (1+2)	VII/XI
GP 402	Special Techniques in Plant Breeding	3 (1+2)	VII/XI
GP 403	Heterosis Breeding in Crop Plants	3 (1+2)	VII/XI
GP 404	Plant Genetic Resources	2 (1+1)	VII/XI
GP 405	Crop Improvement for Biotic and Abiotic Stress	3 (1+2)	VII/XI
	Total Credits	14 (5+9)	

GP 101

FUNDAMENTALS OF GENETICS

SEM II/VI

3 (2+1)

Theory

Ultra structure of cell and cell organelles and their functions: mitosis and meiosis, their significance and differences between them; Mendel's laws of inheritance and exceptions to the laws; types of gene interaction, multiple alleles, pleiotropism, penetrance and expressivity; law of population equilibrium, quantitative traits, qualitative traits and differences between them; multiple factor hypothesis; cytoplasmic inheritance, its characteristic features and difference between chromosomal and cytoplasmic inheritance; mutation and its characteristic features; methods of inducing mutations and C / B technique; linkage, types of linkage and estimation of linkage; crossing over and factors affecting it; mechanism of crossing over and cytological proof of crossing over; DNA and its structure, function, types, modes of replication and repair; RNA and its structure, function and types; transcription, translation, genetic code and outline of protein synthesis; gene expression and differential gene activation; lac operon and fine structure of gene; numerical chromosomal aberrations (polyploidy) and evolution of different crop species like cotton, wheat, tobacco, triticale and brassicas; structural chromosomal aberrations.

Practical

Preparation of micro slides and identification of various stages of mitosis; preparation of micro slides and identification of various stages of meiosis; monohybrid ratio and its modifications; dihybrid ratio and its modifications; trihybrid ratio; chi-square analysis and interaction of factors; epistatic factors, supplementary factors and duplicate factors; complementary factors, additive factors and inhibitory factors; linkage – two point test cross; linkage – three point test cross; Hardy Wein Berg law of population equilibrium.

Theory

Floral biology, emasculation and pollination techniques in cereals, millets, pulses, oil seeds, fibers, plantation crops etc; aims and objectives of plant breeding; modes of reproduction, sexual, asexual, apomixis and their classification; significance in plant breeding; modes of pollination, genetic consequences, differences between self and cross pollinated crops; methods of breeding: introduction and acclimatization; selection, mass selection, johannson's pure line theory, genetic basis, pure line selection; hybridization, aims and objectives, types of hybridization; methods of handling of segregating generations, pedigree method, bulk method, back cross method and various modified methods; incompatibility and male sterility and their utilization in crop improvement; heterosis, inbreeding depression, various theories of heterosis, exploitation of hybrid vigour development of inbred lines, single cross and double cross hybrids; population improvement programmes, recurrent selection, synthetics and composites; methods of breeding for vegetatively propagated crops; clonal selection; mutation breeding; ploidy breeding; wide hybridization, significance in crop improvement.

Practical

Floral biology; study of megasporogenesis and microsporogenesis; fertilization and life cycle of an angiospermic plant; plant breeder's kit; emasculation and hybridization techniques and precautions to be taken; floral morphology, selfing, emasculation and crossing techniques; study of male sterility and incompatibility in field plots e.g., rice, sorghum, maize, wheat, bajra, sugarcane, groundnut, castor, sesamum, redgram, bengalgram, greengram, soybean, blackgram, chillies, brinjal, tomato; bhendi, onion, bottle gourd, ridge gourd, cotton, mesta, jute, sunhemp.

Theory

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Hardy-Weinberg law; study of origin, distribution of species, wild relatives and forms, cereals, (rice, wheat, maize, millets, sorghum, bajra); pulses (redgram, greengram, blackgram, soybean); oilseeds (groundnut, sesame, sunflower, castor, mustard) etc. fibers (cotton) etc. vegetables (tomato, bhindi, chilli, cucumbers); flowers crops (chrysanthemum, rose, galardia, gerbera and marigold); fruit crops (aonla, guava, mango, custard apple, banana, papaya); major breeding procedures for development of hybrids / varieties of various crops; plant genetic resources their conservation and utilization in crop improvement; ideotype concept in crop improvement (with examples of wheat, rice, maize, sunflower etc.); breeding for resistance to biotic and abiotic stresses; variability in pathogens and pests; mechanisms of resistance in plant to pathogens and pest; genetic basis of adaptability to unfavourable environments; definition and concept of biometrics-assessment of variability i.e. additive, dominance and epistasis and their differentiation; genotype x environment interaction and influence on yield/performance; introduction to IPR and its related issues.

Practical

Emasculation and hybridization techniques; handling of segregating generations, pedigree methods; handling of segregating generations, bulk methods; handling of segregating generations, back cross methods; field lay out of experiments; field trials, maintenance of records and registers; estimation of heterosis and inbreeding depression; estimation of heritability, GCA and SCA; estimation of variability parameters; parentage of released varieties/hybrids; problems on hardy-weinberg law; study of quality characters; sources of donors for different characters; visit to seed production and certification plots; visit to AICRP trials and programmes; visit to grow out test plots; visit to various research stations; visit to other institutions.

GP 301

PRINCIPLES OF PLANT BIOTECHNOLOGY

**SEM V/IX
3 (2+1)**

Theory

Concepts of plant biotechnology: history of plant tissue culture and plant genetic engineering; scope and importance in crop improvement: totipotency and morphogenesis, nutritional requirements of *in-vitro* cultures; techniques of in-vitro cultures, micro propagation, anther culture, pollen culture, ovule culture, embryo culture, test tube fertilization, endosperm culture, factors affecting *in-vitro* culture; applications and achievements; somaclonal variation, types, reasons: somatic embryogenesis and synthetic seed production technology; protoplast isolation, culture, manipulation and fusion; products of somatic hybrids and cybrids, applications in crop improvement; genetic engineering; restriction enzymes; vectors for gene transfer, gene cloning, direct and indirect method of gene transfer, transgenic plants and their applications; PCR, blotting techniques (southern, northern, and eastern); DNA probes: DNA finger printing using, DNA markers – RAPD, RFLP, AFLP, SSR, SNP and mapping QTLs, marker assisted selection, and its application in crop improvement, future prospects.

Practical

Requirements for plant tissue culture laboratory; techniques in plant tissue culture- media components and preparations; sterilization techniques and inoculation of various explants; aseptic manipulation of various explants; callus induction and plant regeneration; micro propagation of important crops; anther, embryo and endosperm culture; hardening / acclimatization of regenerated plants; somatic embryogenesis and synthetic seed production; isolation of protoplast; demonstration of culturing of protoplast; demonstration of isolation of DNA; demonstration of gene transfer techniques, direct methods; demonstration of confirmation of genetic transformation (GUS assay/antibiotic resistance techniques); demonstration of gel-electrophoresis techniques.

GP 401

CROP IMPROVEMENT

**SEM VII/XI
3 (1+2)**

Theory

Pollination behaviour in relation to breeding methods; sexual and asexual reproduction; specific breeding objectives of major field crops; mechanisms promoting autogamy and allogamy; genetic basis of breeding self- and cross fertilized crops; seed classification; breeder seed production; seed certification regulations; classification of variability and relative importance of different components of genetic variation in crop improvement; centers of origin, domestication; different breeding methods for developing varieties

including composites/synthetics/hybrids of major field crops; use of general and specific combining ability in crop improvement; importance of varietal resistance and breeding for disease resistance; physiological breeding.

Practical

Selection of plant progenies in relation to breeding objectives; identification of varieties and hybrids of various crops in the field; floral biology of crop plants (wheat, barley, rice, oats, chickpea, peas, mungbean, linseed, lentil, castor, jojoba, guayule, sorghum, maize, berseem, pearl millet, brassica, sunflower, cotton, isabgol, sugarcane) emasculation and pollination techniques-practice of emasculation, pollination and selfing of different crops; prediction of performance of single and double crosses; visit to plant breeding laboratories of neighboring states.

GP 402	SPECIAL TECHNIQUES IN PLANT BREEDING	SEM VII/XI 3 (1+2)
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Theory

Cell division, gametogenesis and fertilization; apomixes: its classification and use; male sterility and its uses in crop improvement; incompatibility mechanisms and their role in plant breeding; role of mutation and polyploidy in plant breeding; intra-and inter-specific hybridization; biotechnology and its role in the improvement of crop species (anther culture, tissue culture, protoplast fusion, micropropagation, molecular marker like RAPD, RFLP, AFLP, SSR, SNP, EST, RGA; marker assisted selection, mapping population).

Practical

Use of male sterility and self incompatibility in hybrids seed production; use of mutagens and colchicines; *in vitro* techniques; methods for producing distant hybrids, study of meiosis and mitosis, flower morphology of male sterile plants, pollen staining by Alexander and Acetocarmine stains, study of lab equipments used for marker analysis.

GP 403	HETEROSIS BREEDING IN CROP PLANTS	SEM VII/XI 3 (1+2)
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Theory

Heterosis breeding: history and introduction; inbreeding: inbreeding depression and heterosis; basis of heterosis: genetical, biometrical, cytological, physiological, and molecular; magnitude of heterosis in relation to genetic diversity and combining ability, exploitation of heterosis; in crop plants; hybrids: single, double, triple cross etc. , synthetics and composites; heterosis and population improvement; male sterility mechanisms: types and their role; use of male sterility systems for hybrid seed production, use of barstar and barnase system for hybrid seed production, chemical hybridizing agents; use of self incompatibility and apomixis mechanisms for exploitation of heterosis in cross and self pollinated crops.

Practical

Development, testing and maintenance of inbreds; production of hybrids and maintenance of A, B and R lines in pearl millet, cotton, maize; use of chemical hybridizing agents in wheat, sunflower and use of TGMS system in rice; identification of male sterility and incompatibility; estimation of heterosis and inbreeding depression; performance prediction in double cross hybrid; detection of hybridity; making single and double crosses using hand emasculation, detasseling and male sterility in crop plants.

GP 404

PLANT GENETIC RESOURCES

SEM VII/XI

2 (1+1)

Theory

Genetic resources: definitions and concepts, germplasm and gene pools: primary, secondary and tertiary; importance of genetic resources in crop improvement, centres of origin and diversity; germplasm exploration, collection, characterization, evaluation and cataloging; germplasm introduction and exchange- *in situ* and *ex situ* conservation of germ plasm; modules for germplasm conservation- short, medium and long term conservation, maintenance of germplasm in relation to breeding behaviour; registration of plant genetic resources.

Practical

Collection of germplasm from various agroecological regions of state, classification of germplasm into different clusters using biometrical approaches, documentation and cataloguing of germplasm, preparing a catalogue of germplasm lines collected by students during field visits; descriptors of important field crops, visit to gene banks like NBPGR, New Delhi and other national facilities.

GP 405

**CROP IMPROVEMENT FOR BIOTIC
AND ABIOTIC STRESSES**

SEM VII/XI

3 (1+2)

Theory

Impact of various stresses on agricultural productivity, classification of biotic stresses, major pests and diseases of economically important crops, nature and mode of resistance - genetics of resistance to biotic stresses, host-pathogen Co-evolution, gene pyramiding, sources of resistance including land races, cultivars, genetic stocks and wild relatives, breeding approaches; use of toxins, protease inhibitors for insect pest management, use of Bt gene; nature and characteristics of environment stresses, stress due to temperature (high temperature, low temperature), stress due to water (less water and excess water), stress due to salinity, alkalinity, etc., stress due to increased level of CO₂, stress due to UV-B radiation and stress due to industrial wastes; variability in germplasm, genetics of resistance to abiotic stresses, genetic adaptation of plants to above stresses, screening techniques and breeding approaches to evolve tolerant/resistant genotypes.

Practical

Pests and diseases, stress situations, phenotypic screening techniques against pests and diseases; demonstration of role of wild relatives in enhancing the level of resistance/tolerance to various stresses, genetics of resistance/tolerance to various stresses; creation of abiotic stresses: pH, temperature induced stress, due to drought, flood, light intensity, wind, problem soils and recording observations; screening of segregating populations, *in-vitro* screening using tissue culture methods; visit to sick plots or nurseries, screening of resistance against seed borne, soil borne and air borne pathogens.

HORTICULTURE

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
HORT 101/ VSC 101	Fruit and Vegetable Production (To be taught jointly by Horticulture and Vegetable Science) (For B. Sc. (Hons.) Home Science)	2 (1+1)	IV/VIII
HORT 201	Production Technology of Fruit Crops	3 (2+1)	III/VII
HORT 202/ AGRON 205/ VSC 202	Production Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Agronomy, Horticulture and Vegetable Science)	2 (1+1)	IV/VIII
HORT 301/ VSC 301	Post Harvest Management of Fruits and Vegetables	2 (1+1)	V/IX
HORT 302	Ornamental Horticulture	2 (1+1)	VI/X
	Total Credits	11 (6+5)	
Elective Courses/Experiential Learning			
HORT 401	Commercial Floriculture	3 (1+2)	VII/XI
HORT 402	Commercial Fruit Production	3 (1+2)	VII/XI
HORT 403	Nursery Management of Horticultural Crops	3 (1+2)	VII/XI
HORT 404/ VSC 402	Processing and Value Addition in Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)	VII/XI
HORT 405/ VSC 404	Protected Cultivation of Horticultural Crops (To be taught jointly by Horticulture and Vegetable Science)	3 (2+1)	VII/XI
HORT406/ VSC 405	Seed Production of Vegetable and Flower Crops (To be taught jointly by Horticulture and Vegetable Science)	2 (1+1)	VII/XI
HORT 407	Post Harvest and Storage Technology of Cut and Dry Flowers	3 (1+2)	VII/XI
HORT 408/ VSC 406	Post Harvest Technology of Spices, Medicinal, Aromatic and Plantation Crops (To be taught jointly by Horticulture and Vegetable Science)	4 (1+3)	VII/XI
HORT 409	Post Harvest Technology of Horticultural Crops	3 (1+2)	VII/XI
	Total Credits	27 (11+16)	

**HORT 101/
VSC 101**

**FRUIT AND VEGETABLE
PRODUCTION**

**SEM IV/VIII
2 (1+1)**

**(To be taught jointly by Horticulture and Vegetable Science)
(For B.Sc. (Hons.) Home Science)**

Theory

Importance of horticulture and its scope in India; preparation of field and pits; methods of propagation of fruit plants; training and pruning of fruit trees; general principles and practices involved in the cultivation of important fruits: mango, guava, kinnow, lemon, papaya and peach under the heads climate, soil important varieties, planting, after care, manuring, irrigation, weeding, harvesting and plant protection measures; importance of vegetables; types of vegetable gardening: kitchen, market and truck gardening; preparation of nursery beds and nursery management; cultivation of important vegetables: tomato, okra, peas, cauliflower, radish and leafy vegetables- beet leaf and fenugreek under the heads climate, soil, sowing/planting, after care, irrigation, manuring, weeding, harvesting and plant protection.

Practical

Identification of different fruit crops; layout, planting of trees; digging and filling of pits; transplanting; practice in propagation methods; pruning, manuring and irrigation of fruit trees; identification of important vegetables and their seeds; layout of kitchen garden; preparation of nursery and seedbeds; transplanting of seedlings.

HORT 201

**PRODUCTION TECHNOLOGY OF
FRUIT CROPS**

**SEM III/VII
3 (2+1)**

Theory

Horticulture: importance and status; fruit zones; classification of fruits based on their edible parts; dormancy, chilling requirement, heat units, juvenility; physiology of flowering and fruit-bud-differentiation; parthenocarpy, C/N ratio, problems of unfruitfulness, fruit development and maturity; protection from frost, chilling injury, cold hardiness, drought and high temperature resistance; modern propagation structures and greenhouses; selection of location and site for planting an orchard, preparation of land and layout; orchard management practices, *viz.* training, pruning, fertilizer application, irrigation, plant protection; cultivation of temperate, sub-tropical and tropical fruits, *viz.* apple, pear, peach, plum, almond, loquat, mango, citrus, grapes, guava, sapota, litchi, ber, phalsa, pomegranate, aonla, jamun, date-palm, papaya, banana and pineapple.

Practical

Identification and description of fruits and their cultivars; plant propagation with seeds, cuttings, layering and grafting; orchard layout and planting systems; methods of pruning and training of fruit trees; methods of irrigation and fertilizer application in fruit crops; preparation of solution of growth regulators for propagation; application of growth regulators for improving fruit set, fruit size, quality, delaying/hastening ripening; visit to local commercial orchards.

Practical

Identification of various ornamental plants; preparation of various types of borders; layout of gardens, parks and college compounds; trimming of shrubs, hedges, climbers and trees; raising of annuals and propagation of ornamental plants; practices in indoor gardening; visit to public parks and gardens.

HORT 401

COMMERCIAL FLORICULTURE

SEM VII/XI

3 (1+2)

Theory

Scope and strategies for growth of floriculture and landscaping in state and country; planning and lay out of gardens; cultivation of rose, gladiolus, chrysanthemum, marigold and tuberose; greenhouse cultivation of roses, carnation and gerbera

Practical

Identification of ornamental plants (annuals, bulbous plants, house plants, shrubs, creepers, trees, etc.), commercial flowers and their varieties; preparation of various types of border; lay out of lawns and maintenance; training and pruning of shrubs and trees; creation and use of topiary in landscaping; training and pruning of rose and chrysanthemum; planning and lay out of gardens; garden designs for public and private areas; propagation of ornamental plants; practices in cultural aspects of ornamental plants and economic flowers; storage of seed bulbs, corms, etc.; greenhouse cultivation of roses, carnation, gerbera; practice of flower arrangements in vases and indoor decoration; bonsai plants; harvesting, grading and packing of flowers; prolonging the shelf life of cut flowers; visit to public parks, gardens and local flower market.

HORT 402

COMMERCIAL FRUIT PRODUCTION

SEM VII/XI

3 (1+2)

Theory

Scope and strategies for growth of fruit cultivation in state and country; planning and lay out of orchards; high density planting; commercial varieties of fruit crops; propagation techniques, crop regulation, fruit set and drop, harvest indices, ripening and export standards for various fruits.

Practical

Commercial propagation methods in mango, citrus, sapota and guava; fertilizer application and field observation of deficiency symptoms of micronutrients in major fruit crops; irrigation and fertigation practices in fruit crops; canopy management in mango (pruning, training, application of paclobutazol, etc.); training and pruning in grape, ber and pomegranate; flower and fruit drop and their control in mango and citrus; hormonal application to improve fruit set, fruit thinning, fruit size and quality in major fruit crops; harvesting indices in mango, banana, papaya and grape; harvesting methods in fruit crops; harvesting, desaping, pre-cooling, grading and palletisation and storage in mango; ripening methods in mango and banana; working out benefit cost ratios for mango, citrus, banana and grape; visit to commercial orchards of important fruit crops, local cold storage and export units of various fruits.

Theory

Introduction and importance of commercial nurseries in India and abroad; planning and execution of a commercial ornamental and fruit plant nurseries, basic general concepts concerning plant propagation; structure of vascular plants; choice of propagation methods including micro-propagation; propagation by specialized vegetative structures specially in flower crops; seed and vegetative propagation; commercial methods of multiplication of flowers and fruit crops; plant propagating structures their importance in propagation: shade houses, tunnels, poly houses, fan and pad type of poly houses; propagation media, characteristics, types of media, natural and synthetic; use of plant growth regulators in rooting of cuttings; study of tools, accessories and other equipment necessary for nursery production of ornamental and fruit crops.

Practical

Preparation of lay out for establishment of mother plant block, commercial nurseries for fruit and ornamental plants; pre-germination treatment of seeds – scarification and stratification; seed viability tests; preparation of raised and flat seed bed to test germination of pre treated seed; preparation of potting mixtures; characteristics of individual media items; preparation of different types of cuttings (fruits and ornamentals); types of containers, dormancy breaking techniques, multiplication methods of bulbs, tubers and corms; methods of layering in ornamental and fruit crops, raising of rootstocks through seed and clone propagation; pre-curing, preparation of rootstocks for budding and grafting of important ornamental and fruit crops; commercial methods and practices of propagation of the crops: fruits: i) mango, ii) guava iii), *chiku*, iv) sweet orange and mandarins, v) litchi, (vi) datepalm, vii) *ber*, viii) *aonla*, ix) pomegranate, ornamental plants: i) roses ii) indoor decorative plants, iii) shrubs and bushes, planning for construction of shade houses, poly tunnels, poly houses and furniture suitable for propagation therein; preparation of media for micro-propagation, preparation of aseptic cultures for propagation of important ornamental plants like gerbera and chrysanthemum and fruit crops like banana; hardening of plants propagated through tissue culture; visit to commercial nurseries and tissue culture labs to study methods of propagation/ multiplication of plants.

(To be taught jointly by Horticulture and Vegetable Science)

Theory

Nutritional importance of fruits and vegetables; scope and importance of establishing processing industries in India; product mix, raw materials, manpower, capital, marketing, transport, availability of containers, publicity and role of government; food products order and quality control (Agmark); equipments used in the processing of various vegetables and fruit products; food spoilage: microbial spoilage and enzymatic spoilage; tin, glass and plastic containers; canning process: selection of fruits and vegetables, grading, washing, peeling, cutting, blanching, cooling, filling, exhausting, sealing, processing, cooling and storage; spoilage of canned foods: swell, hydrogen swell, springer, flipper, flat sour, leaker, breather and bursting of cans; preparation of value added products such as jam, jelly, marmalade, sauce and ketchup; fruits beverages: unfermented and fermented beverages, preparation and preservation of unfermented fruit beverages such as juice, squash and

cordial; preparation of fermented beverages such as wine and vinegar; drying and dehydration– sun drying and mechanical dehydration- homemade drier, commercial dehydrators like kill drier, stack drier etc.; preparation of pickles, pickling process– dry salting, fermentation in brine, kinds of spoilages in pickles– shriveling, bitter taste, blackening, dull or faded product, softness or slipperiness, sum formation, cloudiness, blemishes in pickles.

Practical

Identification of machinery and equipments used in vegetable and fruit processing industry; canning of fruits and vegetables; material handling systems for horticultural crops; preparation of jam, jelly, juice, squash, cordial; fruit cheese, ketchup and sauce, pickles (mango, tomato, etc.), amchur; dehydration of banana, grape, onion and potato, visit to beverage and food processing industry, quality control in fruits and vegetable products.

**HORT 405/
VSC 404**

**PROTECTED CULTIVATION OF
HORTICULTURAL CROPS**

**SEM VII/XI
3 (2+1)**

(To be taught jointly by Horticulture and Vegetable Science)

Theory

Introduction, history, definition, world scenario, greenhouse effect, uses of greenhouse, status and scope of greenhouse technology in India, choice of crops for cultivation under greenhouse, problems/constraints of greenhouse cultivation and future strategies; planning and designing for greenhouses: site selection, greenhouse orientation, plant, layout, greenhouse utilities– water, electricity, etc.; types of greenhouse: classification based on the shape, material, utility and covering material; considerations for greenhouse establishment; design load calculations; materials for construction of greenhouse: fabrication of frame, covering/cladding of frame and environmental control system; management of greenhouse: temperature, light, relative humidity, ventilation, carbon dioxide, irrigation, nutrition, pests and diseases; methods of greenhouse cooling and ventilation – natural and forced ventilation; roof shading, lathe shades and evaporative cooling with fan and pad system, high/low pressure misting and fog cooling system, maintenance of greenhouse equipments, heating, heat distribution and conservation practices; carbon dioxide solid and carbon dioxide; light control in greenhouse– shading and selection of light source; growing media: soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization, organic matter, pH control, pre-crop (base) fertilizer application and cultivation in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT)/hydroponics; detailed production technology of vegetables: tomato, capsicum, lettuce and cucumber; cut flowers: rose, chrysanthemum, carnation, gerbera and anthurium; major diseases and insect pests and their management in greenhouse crops; marketing of greenhouse crops.

Practical

Study of various types of greenhouse/poly house and their suitability for different crops, various framework materials used in the greenhouse construction; cladding materials used for covering the greenhouse, equipments used in the greenhouses, growing media used in raising of greenhouse crops and their preparation and pasteurization/sterilization; testing suitability of soil and water for growing crops in greenhouse; light, humidity and temperature management in greenhouse; calculation of nutrient requirement for different crops; fertigation requirements for greenhouse crops; working and requirement for reducing the water pH; estimation of E.C. in the fertigation solution; practicing training and pruning

in rose, carnation, tomato, cucumber, etc.; post-harvest handling of greenhouse crops; visit to commercial greenhouses and flower markets.

HORT 406/ VSC 405 **SEED PRODUCTION OF VEGETABLES AND FLOWER CROPS** **SEM VII/XI**
2 (1+1)
(To be taught jointly by Horticulture and Vegetable Science)

Theory

Scope and importance of vegetable and flower seed industry in India; different categories of seed, influence of self and cross pollination on seed setting, isolation distance and pollinators; techniques of seed production: annual and biennial habits with reference to seed production in different vegetable and flower crops; factors influencing seed production on dioecious, monoecious and hermaphrodite crops; seed harvesting, curing, extraction, cleaning, drying, grading, packing and storage; viability maintenance, control of seed borne diseases and insect pests; minimum seed standards of vegetables and flower crops for germination; seed certification and seed Act.

Practical

Classes of seed and its standards; seed viability tests; methods of breaking seed dormancy; identification and description of varieties in different vegetable crops and flowering annuals; isolation distance followed in different vegetable crops; planning and lay out of commercial vegetable seed production plots; raising of nursery in vegetable crops; hardening of seedlings; sowing of leguminous and cucurbitaceous vegetables; rouging (removal of off-type plants) in vegetable seed production plots at vegetative phase; rouging of vegetable seed production plots at reproductive phase and pre-harvest stage; demonstration of seed extraction methods in tomato, brinjal, chilli, etc.; drying, cleaning, grading and packing of vegetable seeds; raising of nurseries of annual flowering plants; methods of planting flowering annuals; use of growth regulators in propagation of ornamental plants; propagation of flowering plants through cuttings, layering and budding; layout and establishment of commercial nurseries; visit to commercial nurseries; seed production farms of vegetables and flowers, seed testing laboratories, seed processing industries.

HORT 407 **POST HARVEST AND STORAGE TECHNOLOGY OF CUT AND DRY FLOWERS** **SEM VII/XI**
3 (1+2)

Theory

Importance of post harvest technology, factors responsible for post harvest losses in flowers, post harvest physiology of flowers, methods to improve the shelf life of cut flowers; post harvest handling of cut flowers: grading, packing, transportation and marketing; flower arrangements, storage of cut flowers, types of storage; dry flowers: importance, uses and export potential, methods of dehydration of flowers, methods to improve the shelf life of dried flowers; home scale drying flower.

Practical

Maturity indices of various flowers, grading and packing of cut flower, practices in different types of flower arrangement, use of chemicals for increasing vase life, cold chain, drying of flowers through different methods, dry flower arrangements, visit to flower export houses.

**HORT 408/
VSC 406**

**POST HARVEST TECHNOLOGY OF
SPICES, MEDICINAL, AROMATIC AND
PLANTATION CROPS**

**SEM VII/XI
4 (1+3)**

(To be taught jointly by Horticulture and Vegetable Science)

Theory

Introduction, factors affecting the maturity and quality of spices, medicinal, aromatic and plantation crops; post-harvest handling, types of equipments required for drying, processing, grading, packing, storage and marketing of spice crops: ginger, turmeric, black pepper, cardamom, clove, cinnamon, garlic, chilli, coriander, cumin, fenugreek; medicinal plants: opium, *Solanum viarum*, isabgol, senna, *Catharanthes roseus*, guggul, coleus, aloe vera, *Ocimum* sp., *Acorus*, aswagandha and *Rauwolfia serpentine*; aromatic crops: lemon grass, citronella, palmarosa, vetiver, geranium, mint, davana and eucalyptus; plantation crops: coconut, oil palm cashew, tea, coffee, areca-nut, cacao, rubber, betel vine; extraction of essential oils, storage and uses of aromatic oils; equipments for extraction of essential oil in aromatic plants.

Practical

Study of maturity standards in spices, medicinal, aromatic and plantation crops, post-harvest handling and processing in turmeric, ginger (dry ginger and paste), garlic and chilli, coriander, cumin and fenugreek; equipments required for processing of spices; establishment of processing units for spice crops; visit to processing units of plantation and spice crops; practices in judging the maturity and maturity standard in lemon grass, citronella, palmarosa and vetiver, geranium and eucalyptus; maturity standards, post-harvest handling in *Solanum viarum*, isabgol, *Aloe vera* and guggul; quality standards in medicinal and aromatic plants; equipments and their functioning for post-harvest handling and process distillation of medicinal and aromatic plants; visit to essential oil extraction units and medicine manufacturing units.

HORT 409

**POST-HARVEST TECHNOLOGY OF
HORTICULTURAL CROPS**

**SEM VII/XI
3 (1+2)**

Theory

Post-harvest management, its importance and scope; methods of determining maturity indices; post-harvest operation like harvesting, sorting, grading, packaging, storage, marketing and transportation of important fruit and vegetable crops.

Practical

Identification and handling of equipment of post-harvest management and processing; practices in harvesting, grading, packaging and storage; visit to processing units.

NEMATOLOGY

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
NEMA 201/ ENT 202/ PL PATH 203	Plant Protection (To be taught jointly by Entomology, Plant Pathology and Nematology - 40: 40:20) (For B. Sc. (Hons.) Home Science)	2 (0+2)	VI/X
NEMA 301	Introductory Nematology	3 (2+1)	VI/X
	Total Credits	5 (2+3)	
Elective Courses/Experiential Learning			
NEMA 401	Nematode Pests of Crops and their Management	3 (1+2)	VII/XI
	Total Credits	3 (1+2)	

NEMA 201/ **PLANT PROTECTION** **SEM VI/X**
ENT 202/ **2 (0+2)**
PL PATH 203
(To be taught jointly by Entomology, Plant Pathology and Nematology-40: 40:20)
(For B.Sc. (Hons.) Home Science)

Practical

Familiarization, identification, nature of damage and management of important insect pests of wheat, rice, cotton, chickpea, sugarcane, horticultural crops, stored grain pests, household pests; methods of pest control: physical, mechanical, cultural and chemical; bio-pesticides; integrated pest management; familiarization with insecticides and their identification, formulation and safe use of pesticides; plant diseases: symptoms and etiology- fungi, prokaryotes, viruses and viroids; symptoms and management of important plant diseases of wheat, rice, cotton, chickpea, sugarcane and horticultural crops; plant protection equipments; fungicides, their formulations and uses; nematodes: familiarization, nature of damage and symptoms of damage in wheat, rice, cotton and horticultural crops.

NEMA 301 **INTRODUCTORY NEMATOLOGY** **SEM VI/X**
3 (2+1)

Theory

Introduction, kinds and habitats of nematodes; history of phytonematology; economic importance of phytonematodes; gross morphology of plant parasitic nematodes; classification of nematodes up to family level with emphasis on groups containing important plant parasitic genera; biology and ecology of plant parasitic nematodes; nature of damage and general symptomatology; principles and practices of nematode management.

Diagnosis, hosts, distribution, biology, symptoms and management of important plant parasitic nematodes viz., *Meloidogyne* spp., *Heterodera avenae*, *Globodera rostochiensis* and *G. pallida*, *Radopholus similis*, *Hirschmanniella oryzae*, *Pratylenchus* spp., *Tylenchulus semipenetrans*, *Rotylenchulus reniformis*, *Anguina tritici*, *Aphelenchoides besseyi*, *Ditylenchus angustus*.

Practical

Collection of soil and plant samples; extraction of nematodes from soil and plant tissues; counting and estimation of nematode populations; killing, fixing and clearing nematodes; preparation of temporary and permanent mounts; study of major morphological characteristics; identification of important plant parasitic nematodes and symptoms caused by them; methods of nematode management.

NEMA 401**NEMATODE PESTS OF CROPS AND
THEIR MANAGEMENT****SEM VII/XI
3 (1+2)****Theory**

Comprehensive account of crop losses caused by nematode pests; symptoms and management of nematode pests of important field and horticultural crops; nematode problems of mushrooms and protected cultivation; nematode management: terminology, ecology as the basis for nematode management, concepts of nematode control and management technology.

Practical

Field visits, isolation and identification of nematodes associated with field, vegetable, fruits crops, mushroom and protected cultivation; demonstration of nematode management technology: plastic mulching, summer solarisation, application of chemical nematicides and bio-agents.

Practical

Acquaintance to plant pathology laboratory and equipments; preparation of culture media for *fungi* and *bacteria*; isolation techniques, preservation of disease samples; study the species of genera *Pythium*, *Phytophthora*, *Albugo*; *Sclerospora*, *Peronosclerospora*, *Pseudoperonospora*, *Peronospora*, *Plasmopara* and *Bremia*; study the sp. of genera *Mucor*, *Rhizopus*, *Aspergillus*, *Penicillium*, *Oidium*, *Oidiopsis*, *Ovulariopsis*, *Erysiphe*, *Phyllactinia*, *Uncinula* and *Podosphaera*; study the sp. of genera *Puccinia* (different stages), *Uromyces*, *Hemileia*; *Sphacelotheca*, *Ustilago*, *Tolyposporium*; *Agaricus*, *Pleurotus* and *Ganoderma*; study the species of genera *Septoria*, *Colletotrichum*, *Pestalotiopsis*, *Pyricularia*; *Trichoderma*, *Fusarium*; *Helminthosporium*, *Drechslera*, *Alternaria*, *Stemphyllium*, *Cercospora*, *Phaeoisariopsis*, *Rhizoctonia* and *Sclerotium*; demonstration of Koch's postulates; study of different groups of fungicides and antibiotics; preparation of fungicides: bordeaux mixture, bordeaux paste, chestnut compound; methods of application of fungicides: seed, soil and foliar; bio-assay of fungicides – poisoned food technique, inhibition zone technique and slide germination technique; bio-control of plant pathogens: dual culture technique, seed treatment; visit to quarantine station and remote sensing laboratory.

PL PATH 202

**DISEASES OF FIELD CROPS AND
THEIR MANAGEMENT**

**SEM IV/VIII
3 (2+1)**

Theory

Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, sugarcane, tobacco, groundnut, sesamum, sunflower, cotton, redgram, bengalgram, blackgram, greengram, soybean.

Practical

Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases; presentation of disease samples survey and collection of diseases of rice, sorghum; diseases of wheat, bajra and maize; diseases of sugarcane, turmeric and tobacco; diseases of groundnut, castor and sunflower; diseases of sesamum and cotton; diseases of redgram, greengram, blackgram, bengalgram and beans; field visits at appropriate time during the semester.

Note: Students should submit 50 pressed, well mounted different diseased specimens related to different crops in practical examination during the end of semester.

**PL PATH 203
ENT 202/
NEMA 201**

PLANT PROTECTION

**SEM VI/X
2 (0+2)**

**(To be taught jointly by Entomology, Nematology and Plant Pathology)
(For B.Sc. (Hons.) Home Science)**

Practical

Familiarization, identification, nature of damage and management of important insect pests of wheat, rice, cotton, chickpea, sugarcane, horticultural crops, stored grain pests, household pests; methods of pest control: physical, mechanical, cultural and chemical; bio-pesticides; integrated pest management; familiarization with insecticides and their identification, formulation and safe use of pesticides; plant diseases: symptoms and etiology- fungi, prokaryotes, viruses and viroids; symptoms and management of important plant diseases of

SEED SCIENCE & TECHNOLOGY

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
SST 101	Principles of Seed Technology	3 (2+1)	I/V
	Total Credits	3 (2+1)	
Elective Courses/Experiential Learning			
SST 401	Seed Production and Certification	3 (1+2)	VII/XI
SST 402	Seed Testing and Quality Control	3 (1+2)	VII/XI
	Total Credits	6 (2+4)	

SST 101

PRINCIPLES OF SEED TECHNOLOGY

SEM I/V
3 (2+1)

Theory

Introduction to seed production; deterioration of crop varieties; maintenance of genetic purity during seed production; seed quality; different classes of seed, seed production of field and vegetable crops; seed certification, phases of certification, procedure for seed certification, field inspection and field counts etc.; seed act, central seed committee, central seed certification board, state seed certification agency, central and state seed testing laboratories; duties and powers of seed inspectors, offences and penalties; seed control order: introduction to WTO; varietal identification through grow-out test and electrophoresis; seed drying; seed processing plant; establishing a seed testing laboratory, seed testing procedures for quality assessment, seed treatment, importance of seed treatment, types of seed treatment, seed packing and seed storage, stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage, general principles of seed storage, measures for pest and disease control, temperature control, seed marketing, factors affecting seed marketing.

Practical

Seed sampling principles and procedures; physical purity analysis of field crops; germination analysis of field crops; moisture tests of field crops; viability test of field crops; seed health test of field crops; seed dormancy and breaking methods; grow out tests for varietal identification; visit to seed production plots; visit to seed processing plants; visit to seed testing laboratories; planting ratios, isolation distance and rouging, etc.

SST 401

**SEED PRODUCTION AND
CERTIFICATION**

SEM VII/XI
3 (1+2)

Theory

Importance of quality seed in relation to crop production; testing, release, notification and maintenance of varieties and hybrids of field crops; classes of seed; generation system of seed multiplication; factors affecting deterioration and maintenance of genetic purity of crop varieties; factors affecting seed quality during production; principles and methods of seed production in self and cross-pollinated field and vegetable crops; hybrid seed production technology of field crops; seed certification: definition, phases and procedure for seed certification, field inspection; seed act and policies, WTO, IPR; seed village concept.

Practical

Selection of suitable area for seed production; grow-out test for genetic purity analysis; identification of crop and objectionable weed seeds; identification of crop varieties/hybrids; determination of land requirement and isolation distance in field crops; seed production techniques of field and vegetable crops; seed production techniques of cross-pollinated crops; hybrid seed production in field crops; hybrid seed production in vegetable crops; rouging (removal of off-type plants) in seed production plots; procedure for seed certification; field inspection at various stages of seed production; visit to seed production field and processing plants of various public and private seed companies.

SST 402

SEED TESTING AND QUALITY CONTROL

**SEM VII/XI
3 (1+2)**

Theory

Seed testing: definition and its importance; historical development of seed testing; establishment of seed testing laboratories; different types of seeds and their structure and chemical composition; seedling structures of monocot and dicots; seed sampling; moisture determination; physical purity analysis; germination testing of field and horticultural crops; viability and vigour testing; seed dormancy and its alleviation; genetic purity analysis and varietal identification by various techniques; seed health testing: detection and identification of seed-borne pathogens and storage insects; seed storage: factors affecting storability and longevity; packaging, labeling; storage methods; seed marketing; seed standards.

Practical

Identification and handling of seed testing equipments; structure of different monocots and dicots; structure of seedling of monocots and dicots; sampling procedure in seed stores; sampling procedures in seed testing laboratory; procedure for physical purity analysis; moisture determination in various field and vegetable crops; germination testing methods field and vegetable crops; quick viability testing (Tz test) in field crops; vigour testing in different crops by various tests; seed dormancy breeding methods; varietal identification and genetic purity analysis by grow-out test and laboratory techniques; prediction of relative storability by accelerated ageing technique in different crops; detection and identification of seed-borne pathogens; detection of damage and identification of storage insect-pests of various field crops.

SOIL SCIENCE

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
SOILS 101	Introduction to Soil Science	3 (2+1)	I/V
SOILS 102	Soil Fertility, Soil Chemistry and Nutrient Management	3 (2+1)	II/VI
SOILS 201	Manures, Fertilizers and Agro-Chemicals	3 (2+1)	III/VII
	Total Credits	9 (6+3)	
Elective Courses/Experiential Learning			
SOILS 401/ AGM 402	Remote Sensing, GIS and Land Use Planning (To be taught jointly by Agricultural Meteorology and Soil Science)	3 (1+2)	VII/XI
SOILS 402	Soil Management	3 (1+2)	VII/XI
	Total Credits	6 (2+4)	

SOILS 101 INTRODUCTION TO SOIL SCIENCE SEM I/V
3 (2+1)

Theory

Concept of land, soil and soil science; origin of the earth, earth crust and its composition; soil forming rocks and minerals; weathering; soil formation: factors and processes; composition of soil; soil profile; soil colour; taxonomic classification of soils; soils of Haryana and India; soil texture; particle size analysis; soil structure and aggregation-classification and significance; soil consistency; bulk density, particle density and porosity of soils; soil crusting; soil compaction; soil water- retention and potential; soil moisture constants; movement of soil water; soil temperature and thermal properties; soil air and gaseous exchange; influence of soil temperature and air on plant growth; soil colloids and their significance; layered silicate clays - genesis, charges; adsorption of ions, ion exchange and its significance; soil reaction; soil organic matter- composition, decomposition, mineralization and humus and its fractionation; soil organisms and their significance.

Practical

Identification of rocks and minerals; study and description of a soil profile; determination of bulk density and particle density; soil strength; soil moisture determination; determination of field capacity, infiltration rate, water holding capacity; mechanical analysis of soil; soil temperature; collection and processing of soil samples; determination of organic carbon, pH and electrical conductivity.

SOILS 102 SOIL FERTILITY, SOIL CHEMISTRY SEM II/VI
AND NUTRIENT MANAGEMENT 3 (2+1)

Theory

Soil fertility and productivity; essential and beneficial nutrient elements, criteria of essentiality, available forms, mechanism of nutrient transport to plants, functions and deficiency symptoms in plants, factors affecting nutrients availability, remediation /amelioration of deficiencies and toxicities; microbiological transformations of C, N and S

in soils; problem soils: acid, salt affected and calcareous and their characteristics, nutrients availability and reclamation (mechanical, chemical and biological); irrigation water: quality and its appraisal, use of brackish water in agriculture; soil fertility evaluation and soil testing; critical levels of nutrients in soils and plants; plant analysis techniques; indicator plants; biological methods of soil fertility evaluation; introduction to manures and fertilizers; soil test based fertilizer recommendations to crops; integrated nutrient management; factors influencing nutrient use efficiency in respect of N, P, K, S and Zn fertilizers; sources, methods and scheduling of nutrients for different soils and crops grown under rain fed and irrigated conditions.

Practical

Principles of spectrophotometer, flame photometer and atomic absorption spectrophotometer; principles of extraction of available nutrients from soil and digestion of plant material for analysis; estimation of available N, P, K, S in soils; determination of CaCO_3 ; determination of pH, EC, CO_3^{2-} , HCO_3^- , Ca^{++} and Mg^{++} in irrigation water; lime and gypsum requirement of problem soils; estimation of N, P, K, Zn, Fe, Cu and Mn in plants.

SOILS 201 **MANURES, FERTILIZERS AND AGRO-CHEMICALS** **SEM III/VII**
3 (2+1)

Theory

Manures: bulky and concentrated, FYM; methods of composting, suitable plants/plant residues for composting, vermicompost, green manure, oil cakes; sewage and sludge: biogas plant slurry, plant and animal refuges; fertilizers: classifications, manufacturing processes and properties of major nitrogenous, phosphatic, potassic and complex fertilizers, their fate and reactions in the soil; secondary and micronutrient fertilizers; amendments; fertilizer control order; fertilizer storage; biofertilizers; organic chemistry as prelude to agro chemicals; diverse types of agro-chemicals; botanical insecticides (Neem); pyrethrum; synthetic pyrethroids; synthetic organic insecticides- major classes, properties and uses of some important insecticides under each class; herbicides: major classes, properties and uses of 2,4-D, atrazine, glyphosate, butachor, benthocarb; fungicides: major classes, properties and uses of carbendazin, carboxin, captan, tridemorph, copper oxychloride; insecticides Act; plant growth regulator; adsorption and persistence of different agro-chemicals in soils.

Practical

Determination of total nitrogen and phosphorus in manures/composts; vermin-composting; COD in organic wastes; ammonical and nitrate nitrogen, water soluble phosphorus, potassium, calcium, sulphur and zinc content of fertilizers; adulteration in fertilizers; argentimetric and iodometric titrations- their use in the analysis of lindane, metasystox, endosulfan, malathion, copper and sulphur fungicides; compactability of fertilizers with pesticides.

SOILS 401/ **REMOTE SENSING, GIS AND LAND** **SEM VII/XI**
AGM 402 **USE PLANNING** **3 (1+2)**

**(To be taught jointly by Agricultural
Meteorology and Soil Science)**

Theory

Geographic co-ordinate system; map as a geographic model; types of maps and map reading; basic concepts of remote sensing and GIS; geographical feature abstraction;

geographic information- data, features and maps; concept of raster and vector data; land use planning: concept, techniques and factors governing present land use; land evaluation methods and soil suitability evaluation for different crops; land capability classification and constraints in application.

Practical

Use of aerial photographs, RS imagery, toposheets and other maps; ground truth study using GPS and visual markings; supervised and unsupervised classification of digital image; digitization of maps; composing maps; use of arc catalogue, arc map, arc editor in GIS registration; geo-referencing of images and maps, editing of attribute tables, field survey, overlay, network, proximity and spatial analysis; soil survey of project area: analysis of soil characteristics and soil classification, preparation of erosion risk assessment maps and report writing.

SOILS 402

SOIL MANAGEMENT

**SEM VII/XI
3 (1+2)**

Theory

Soil as water reservoir and role in water cycle; soil erosion: types, effects, mechanism and control/management; origin and basic concept of problematic soils and factors responsible; characterization of salt-affected soils and their morphological features; management of salt-affected, acid and physically constrained soils; management principles for sandy, clayey, red lateritic and dry land soils; soil health and soil quality; soil properties used as indicators of soil quality.

Practical

Measurement and estimation of runoff and soil loss; estimation of erosivity and erodibility indices; identification of problematic soils by analyzing for pH, E_c, soluble cations (Na⁺, K⁺, Ca⁺⁺ and Mg⁺⁺) and anions (Cl⁻, SO₄⁻⁻, CO₃⁻⁻ and HCO₃⁻); lime requirements of acid soil; gypsum requirement of sodic soil; monitoring of soil salinity in the field; assessment of a soil for its quality in terms of physical, chemical and biological properties.

**VSC 301/
HORT 301**

**POST-HARVEST MANAGEMENT OF
FRUITS AND VEGETABLES**

**SEM V/IX
2 (1+1)**

(To be taught jointly by Horticulture and Vegetable Science)

Theory

Importance and scope of post-harvest technology of horticultural crops; post-harvest classification of fruits and vegetables; maturity indices; changes during maturity and ripening; harvesting and post-harvest operations like, curing, pre-cooling, sorting, grading, trimming, bunching, washing, drying, waxing, packaging and storage of fruits and vegetables; cold chain storage systems; causes of post-harvest losses and their control measures; principles and methods of preservation of fruits and vegetables

Practical

Practice in judging maturity of various fruits and vegetables; determination of PLW, TSS, sugars, acidity and ascorbic acid in fruits and vegetables; types and methods of packaging; methods of prolonging storage life; effect of ethylene on ripening of banana/mango; identification of equipments and machinery used for preservation of fruits and vegetables; preparation of jam, jelly, marmalades, juices, squashes, chutneys, pickles and ketchup; visit to local processing units

VSC 401

**COMMERCIAL VEGETABLE
PRODUCTION**

**SEM VII/XI
3 (1+2)**

Theory

Prospects and constraints in commercial vegetable production in India, use of plant growth substances, use of mulches, off-season and organic vegetable production technology, hi-tech methods in commercial production of vegetable crops such as potato, tomato, brinjal, chilli, okra, sweet potato, onion, garlic, peas, beans, cauliflower, cabbage, radish, carrot, turnip, beet root, cucurbits, beet leaf and fenugreek.

Practical

Study of morphology of different parts of vegetable crops, cultural operations in raising vegetables, practices in use of plant growth regulators, weedicides, mulching, manures and fertilizers, irrigation and fertigation, training, pruning, staking and techniques of commercial vegetable production, visit to commercial vegetable farms.

**VSC 402/
HORT 404**

**PROCESSING AND VALUE ADDITION
IN HORTICULTURAL CROPS**

**SEM VII/XI
3 (2+1)**

(To be taught jointly by Horticulture and Vegetable Science)

Theory

Nutritional importance of fruits and vegetables; scope and importance of establishing processing industries in India; product mix, raw materials, manpower, capital, marketing, transport, availability of containers, publicity and role of government; food products order and quality control (Agmark); equipments used in the processing of various vegetables and fruit products; food spoilage: microbial spoilage and enzymatic spoilage; tin, glass and plastic containers; canning process: selection of fruits and vegetables, grading, washing, peeling, cutting, blanching, cooling, filling, exhausting, sealing, processing, cooling and storage; spoilage of canned foods: swell, hydrogen swell, springer, flipper, flat sour, leaker, breather and bursting of cans; preparation of value added products such as jam, jelly,

marmalade, sauce and ketchup; fruits beverages: unfermented and fermented beverages, preparation and preservation of unfermented fruit beverages such as juice, squash and cordial; preparation of fermented beverages such as wine and vinegar; drying and dehydration-sun drying and mechanical dehydration- homemade drier, commercial dehydrators like kill drier, stack drier etc.; preparation of pickles, pickling process– dry salting, fermentation in brine, kinds of spoilages in pickles– shriveling, bitter taste, blackening, dull or faded product, softness or slipperiness, sum formation, cloudiness, blemishes in pickles.

Practical

Identification of machinery and equipments used in vegetable and fruit processing industry; canning of fruits and vegetables; material handling systems for horticultural crops; preparation of jam, jelly, juice, squash, cordial; fruit cheese, ketchup and sauce, pickles (mango, tomato, etc.), amchur; dehydration of banana, grape, onion and potato, visit to beverage and food processing industry, quality control in fruits and vegetable products.

VSC 403

COMMERCIAL PRODUCTION OF SPICES AND CONDIMENTS

**SEM VII/XI
2 (1+1)**

Theory

History, scope and importance, area and production, uses, export potential of spices and condiments and their role in national economy; classification of spices and condiments, soil and climate requirement, propagation with seed, vegetative and micro propagation, systems and methods of planting, nutritional management, irrigation practices, weed control, mulching and cover cropping, training and pruning, role of growth regulators, shade crops and shade regulation, harvesting, post-harvest management, packaging, storage, value added products, methods of extraction of essential oil and oleoresins, economics of cultivation of crops- cardamom, pepper, ginger, turmeric, clove, nutmeg, cinnamon, allspice, curry leaf, coriander, fenugreek, fennel, cumin, dill, celery, bishops weed, saffron, vanilla, thyme and rosemary.

Practical

Identification of crops and varieties of spices and condiments; layout, seed treatment, propagation- sowing, planting; hoeing and earthing up, manuring and use of weedicides, training and pruning, fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins, visit to commercial plantations

**VSC 404
HORT 405/**

PROTECTED CULTIVATION OF HORTICULTURAL CROPS

**SEM VII/XI
3 (2+1)**

(To be taught jointly by Horticulture and Vegetable Science)

Theory

Introduction, history, definition, world scenario, greenhouse effect, uses of greenhouse, status and scope of greenhouse technology in India, choice of crops for cultivation under greenhouse, problems/constraints of greenhouse cultivation and future strategies; planning and designing for greenhouses: site selection, greenhouse orientation, plant, layout, greenhouse utilities– water, electricity, etc.; types of greenhouse: classification based on the shape, material, utility and covering material; considerations for greenhouse establishment; design load calculations; materials for construction of greenhouse: fabrication of frame, covering/cladding of frame and environmental control system; management of greenhouse: temperature, light, relative humidity, ventilation, carbon dioxide, irrigation, nutrition, pests

and diseases; methods of greenhouse cooling and ventilation – natural and forced ventilation; rood shading, lathe shades and evaporative cooling with fan and pad system, high/low pressure misting and fog cooling system, maintenance of greenhouse equipments, heating, heat distribution and conservation practices; carbon dioxide solid and carbon dioxide; light control in greenhouse– shading and selection of light source; growing media: soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization, organic matter, pH control, pre-crop (base) fertilizer application and cultivation in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT)/hydroponics; detailed production technology of vegetables: tomato, capsicum, lettuce and cucumber; cut flowers: rose, chrysanthemum, carnation, gerbera and anthurium; major diseases and insect pests and their management in greenhouse crops; marketing of greenhouse crops.

Practical

Study of various types of greenhouse/poly house and their suitability for different crops, various framework materials used in the greenhouse construction; cladding materials used for covering the greenhouse, equipments used in the greenhouses, growing media used in raising of greenhouse crops and their preparation and pasteurization/sterilization; testing suitability of soil and water for growing crops in greenhouse; light, humidity and temperature management in greenhouse; calculation of nutrient requirement for different crops; fertigation requirements for greenhouse crops; working and requirement for reducing the water pH; estimation of E.C. in the fertigation solution; practicing training and pruning in rose, carnation, tomato, cucumber, etc.; post-harvest handling of greenhouse crops; visit to commercial greenhouses and flower markets.

**VSC 405/
HORT 406**

**SEED PRODUCTION OF VEGETABLES
AND FLOWER CROPS**

**SEM VII/XI
2 (1+1)**

(To be taught jointly by Horticulture and Vegetable Science)

Theory

Scope and importance of vegetable and flower seed industry in India; different categories of seed, influence of self and cross pollination on seed setting, isolation distance and pollinators; techniques of seed production: annual and biennial habits with reference to seed production in different vegetable and flower crops; factors influencing seed production on dioecious, monoecious and hermaphrodite crops; seed harvesting, curing, extraction, cleaning, drying, grading, packing and storage; viability maintenance, control of seed borne diseases and insect pests; minimum seed standards of vegetables and flower crops for germination; seed certification and seed Act.

Practical

Classes of seed and its standards; seed viability tests; methods of breaking seed dormancy; identification and description of varieties in different vegetable crops and flowering annuals; isolation distance followed in different vegetable crops; planning and lay out of commercial vegetable seed production plots; raising of nursery in vegetable crops; hardening of seedlings; sowing of leguminous and cucurbitaceous vegetables; rouging (removal of off-type plants) in vegetable seed production plots at vegetative phase; rouging of vegetable seed production plots at reproductive phase and pre-harvest stage; demonstration of seed extraction methods in tomato, brinjal, chilli, etc.; drying, cleaning, grading and packing of vegetable seeds; raising of nurseries of annual flowering plants; methods of planting flowering annuals; use of growth regulators in propagation of ornamental plants; propagation of flowering plants through cuttings, layering and budding; layout and

establishment of commercial nurseries; visit to commercial nurseries; seed production farms of vegetables and flowers, seed testing laboratories, seed processing industries.

**VSC 406/
HORT 408**

**POST HARVEST TECHNOLOGY OF
SPICES, MEDICINAL, AROMATIC AND
PLANTATION CROPS**

**SEM VII/XI
4 (1+3)**

(To be taught jointly by Horticulture and Vegetable Science)

Theory

Introduction, factors affecting the maturity and quality of spices, medicinal, aromatic and plantation crops; post-harvest handling, types of equipments required for drying, processing, grading, packing, storage and marketing of spice crops: ginger, turmeric, black pepper, cardamom, clove, cinnamon, garlic, chilli, coriander, cumin, fenugreek; medicinal plants: opium, *Solanum viarum*, isabgol, senna, *Catharanthes roseus*, guggul, coleus, aloe vera, *Ocimum* sp., *Acorus*, aswagandha and *Rauwolfia serpentine*; aromatic crops: lemon grass, citronella, palmarosa, vetiver, geranium, mint, davana and eucalyptus; plantation crops: coconut, oil palm cashew, tea, coffee, areca-nut, cacao, rubber, betel vine; extraction of essential oils, storage and uses of aromatic oils; equipments for extraction of essential oil in aromatic plants.

Practical

Study of maturity standards in spices, medicinal, aromatic and plantation crops, post-harvest handling and processing in turmeric, ginger (dry ginger and paste), garlic and chilli, coriander, cumin and fenugreek; equipments required for processing of spices; establishment of processing units for spice crops; visit to processing units of plantation and spice crops; practices in judging the maturity and maturity standard in lemon grass, citronella, palmarosa and vetiver, geranium and eucalyptus; maturity standards, post-harvest handling in *Solanum viarum*, isabgol, *Aloe vera* and guggul; quality standards in medicinal and aromatic plants; equipments and their functioning for post-harvest handling and process distillation of medicinal and aromatic plants; visit to essential oil extraction units and medicine manufacturing units.

OTHERS

Course No.	Course Title	Credits	Semester (4-yr/6-yr)
Core courses			
LPM 101	Livestock Production and Management	3 (2+1)	II/VI
	Total Credits	3 (2+1)	

LPM 101

**LIVESTOCK PRODUCTION AND
MANAGEMENT**

**SEM II/VI
3 (2+1)**

Theory

Importance of livestock in the national economy; present status and future prospects of various livestock development programmes in India; important breeds of cattle, buffalo, sheep, goat and swine; factors effecting, reproduction in farm animals; selection and breeding of livestock for higher milk and meat production; milk secretion, milking of animals and factors affecting milk yield and composition; feeding and management of calves, growing, heifers and milch animals etc.; housing and rearing systems for different species of livestock; disease control, health management and animal farm waste management practices; animal farm records; cost of milk production and economics of viable units of cattle, buffalo, sheep, goat and swine; classification of poultry and characteristics of important breeds; methods of rearing, breeding, feeding and management, incubation and hatching, brooding, vaccination and prevention of diseases, preservation of egg and meat, cost of production etc.

Practical

Visit to livestock farms; identification, handling and restraining of animals; selection, judging and culling of dairy animals; feeding techniques and ration formulation; disease control, housing and feeding practices; economics of livestock production; incubation hatching, housing and management of poultry.