

B. SC. (HONS.) AGRICULTURE SYLLABUS 2016 BATCH ONWARDS
(UPDATED ON 24.05.2019)

Course scheme B Sc (Hons.) Agriculture - VIIth sem.

Elective Specialized Courses (NOTE: Student will select ANY ONE GROUP of Elective Specialized Courses out of the following five groups of elective specialized courses as per his / her choice.)

1. Natural Resource Management (Soil , Agronomy &Agro-forestry)

34 Hrs.

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology (Practical)	0	0	2	20	30	50	1
Elective courses: Natural Resource Management (Soil , Agronomy &Agro-forestry)								
BAGE2-701	Soil Physical and Biological Environment	2	0	0	40	60	100	2
BAGE2-702	Analytical Techniques in Soils, Plants, Fertilizers and Water	2	0	0	40	60	100	2
BAGE2-703	Weed Management	2	0	0	40	60	100	2
BAGE2-704	Farming Systems and Sustainable Agriculture	2	0	0	40	60	100	2
BAGE2-705	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops	2	0	0	40	60	100	2
BAGE2-706	Production Technology of Economic Forest Trees	2	0	0	40	60	100	2
BAGE2-707	Soil Survey, Classification and Mapping (Practical)	0	0	2	20	30	50	1
BAGE2-708	Soil Physical and Biological Environment (Practical)	0	0	2	20	30	50	1
BAGE2-709	Analytical Techniques in Soils, Plants, Fertilizers and Water (Practical)	0	0	6	60	90	150	3
BAGE2-710	Weed Management (Practical)	0	0	2	20	30	50	1
BAGE2-711	Farming Systems and Sustainable Agriculture (Practical)	0	0	2	20	30	50	1
BAGE2-712	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops (Practical)	0	0	2	20	30	50	1
BAGE2-713	Production Technology of Economic Forest Trees (Practical)	0	0	2	20	30	50	1
	Total	14	0	20	480	720	1200	24

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2.Horticulture (Pomology, Olericulture &Floriculture)

32 Hrs.

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology (Practical)	0	0	2	20	30	50	1
Elective courses: Horticulture (Pomology, Olericulture &Floriculture)								
BAGE3-701	Nursery Management of Horticultural Crops	2	0	0	40	60	100	2
BAGE3-702	Commercial Fruit Production	2	0	0	40	60	100	2
BAGE3-703	Processing and Value Addition of Horticultural Crops	2	0	0	40	60	100	2
BAGE3-704	Commercial Vegetable Production	2	0	0	40	60	100	2
BAGE3-705	Vegetable Breeding and Seed Production	2	0	0	40	60	100	2
BAGE3-706	Forcing Techniques in Vegetable Production	2	0	0	40	60	100	2
BAGE3-707	Commercial Floriculture and Landscaping	2	0	0	40	60	100	2
BAGE3-708	Nursery Management of Horticultural Crops(Practical)	0	0	2	20	30	50	1
BAGE3-709	Commercial FruitProduction (Practical)	0	0	2	20	30	50	1
BAGE3-710	Processing and Value Addition of Horticultural Crops (Practical)	0	0	2	20	30	50	1
BAGE3-711	Commercial Vegetable Production (Practical)	0	0	2	20	30	50	1
BAGE3-712	Vegetable Breeding and Seed Production (Practical)	0	0	2	20	30	50	1
BAGE3-713	Forcing Techniques in Vegetable Production (Practical)	0	0	2	20	30	50	1
BAGE3-714	Commercial Floriculture and Landscaping (Practical)	0	0	2	20	30	50	1
	Total	16	0	16	480	720	1200	24

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3. CROP IMPROVEMENT (Plant Breeding, Genetics and Biotechnology) 31 Hrs

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology (Practical)	0	0	2	20	30	50	1
Elective courses: Crop Improvement								
BAGE4-701	Genetics of Crop Plants	2	0	0	40	60	100	2
BAGE4-702	Cytogenetics of Crop Plants	2	0	0	40	60	100	2
BAGE4-703	Theory and Practice of Plant Breeding	3	0	0	60	90	150	3
BAGE4-704	Breeding of Field Crops	3	0	0	60	90	150	3
BAGE4-705	Crop Experimentation	1	0	0	20	30	50	1
BAGE4-706	Plant Tissue Culture and Transformation	2	0	0	40	60	100	2
BAGE4-707	Molecular Biotechnology and Genomics	2	0	0	40	60	100	2
BAGE4-708	Genetics of Crop Plants (Practical)	0	0	2	20	30	50	1
BAGE4-709	Cytogenetics of Crop Plants (Practical)	0	0	2	20	30	50	1
BAGE4-710	Theory and Practice of Plant Breeding(Practical)	0	0	2	20	30	50	1
BAGE4-711	Crop Experimentation (Practical)	0	0	2	20	30	50	1
BAGE4-712	Plant Tissue Culture and Transformation (Practical)	0	0	2	20	30	50	1
BAGE4-713	Molecular Biotechnology and Genomics (Practical)	0	0	2	20	30	50	1
	Total	17	0	14	480	720	1200	24

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4. Agri-Economics, Extension & Business Management

29 Hrs

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology	0	0	2	20	30	50	1
Elective courses: Agri-Economics, Extension & Business Management								
BAGE5-701	Visual and Graphic Communication	1	0	0	20	30	50	1
BAGE5-702	Communication and Information Technology	2	0	0	40	60	100	2
BAGE5-703	Behavioural Skills for Human Resource Development	2	0	0	40	60	100	2
BAGE5-704	Micro Economic Analysis	3	0	0	60	90	150	3
BAGE5-705	Macro Economic Analysis	3	0	0	60	90	150	3
BAGE5-706	Financial and Project Management	3	0	0	60	90	150	3
BAGE5-707	Retailing and Supply Chain Management	3	0	0	60	90	150	3
BAGE5-708	Visual and Graphic Communication (Practical)	0	0	2	20	30	50	1
BAGE5-709	Communication and Information Technology (Practical)	0	0	2	20	30	50	1
BAGE5-710	Micro Economic Analysis (Practical)	0	0	2	20	30	50	1
BAGE5-711	Financial and Project Management (Practical)	0	0	2	20	30	50	1
	Total	19	0	10	480	720	1200	24

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5.Plant Protection (Entomology, Plant Pathology and Nematology)

36 Hrs

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-780	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BAGE1-781	Introduction to Molecular Biotechnology	0	0	2	20	30	50	1
Elective courses: Plant Protection (Entomology, Plant Pathology and Nematology)								
BAGE6-701	Apiculture	1	0	0	20	30	50	1
BAGE6-702	Biocontrol and Integrated Pest Management	2	0	0	40	60	100	2
BAGE6-703	Pesticides and Plant Protection Equipment	2	0	0	40	60	100	2
BAGE6-704	Biocontrol and Integrated Disease Management	2	0	0	40	60	100	2
BAGE6-705	Post Harvest Diseases & their Management	2	0	0	40	60	100	2
BAGE6-706	Plant Nematology	1	0	0	20	30	50	1
BAGE6-707	Plant Disease Diagnosis (Practical)	0	0	4	40	60	100	2
BAGE6-708	Apiculture (Practical)	0	0	4	40	60	100	2
BAGE6-709	Biocontrol and Integrated Pest Management (Practical)	0	0	4	40	60	100	2
BAGE6-710	Pesticides and Plant Protection Equipment (Practical)	0	0	2	20	30	50	1
BAGE6-711	Biocontrol and Integrated Disease Management (Practical)	0	0	4	40	60	100	2
BAGE6-712	Post Harvest Diseases & their Management (Practical)	0	0	2	20	30	50	1
BAGE6-713	Plant Nematology (Practical)	0	0	2	20	30	50	1
	Total	12	0	24	480	720	1200	24

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Course Scheme - B Sc (Hons.) Agriculture 8th Semester

Subject Code	Subject Name	L	T	P	Internal	External	Total	Credits
BAGE1-880	On-campus learning	0	0	16	600	-	600	8
BAGE1-881	Industrial attachments (Off campus)	0	0	10	300	-	300	5
BAGE1-882	Rural Experiences	0	0	6	200	-	200	3
BAGE1-883	Documentation, reporting and presentation	0	0	2	100	-	100	1
				34	1200		1200	17

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1. Natural Resource Management (Soil , Agronomy & Agro-forestry)

Introduction to Molecular Biotechnology

Subject Code: BAGE1- 780

LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology. Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses. Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches. DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics. Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D. Watson
2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifelde
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Soil Physical & Biological Environment

Subject Code: BAGE2- 701

LT P C 2 0 0 2

Unit - I

Soil physical properties in relation to crop production. Soil thermal regime and its management.

Unit - II

Soil air - composition, renewal, characterization of soil aeration in relation to plant growth. Movement of water in soil. Infiltration and redistribution of water in soil.

Unit - III

Evaporation from soils and its management. Runoff from the agricultural fields and factors affecting.

Unit - IV

Soil organisms and their distribution, Ecology, classification and activities in soil. Microbiological transformations of C, N and S in soils.

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Books Recommended

1. Introductory to Soil Science by D.K. Das
2. Soil Nutrient by M. Miransari
3. Soil Science and Environment by Henry Wang

Analytical Techniques in Soils, Plants, Fertilizers and Water

Subject Code: BAGE2- 702

L T P C 2 0 0 2

Unit - 1

Colorimetric and flame photometric methods, Atomic absorption spectrophotometry.

Unit - II

Cation and Anion exchange phenomenon and their importance. Ionadsorption, desorption and fixation in soils.

Unit - II

Methods of soil fertility evaluation. Fertilizer control order.

Unit - III

Acid, saline, sodic, calcareous soils and their amelioration.

Unit – 1V

Planning and formulation of project on establishment of soil water and plant testing laboratory.

Books Recommended

1. A Handbook of Soil-Plant-Water-Fertilizer and Manure Analysis by M.V. Durai
2. Soil-Plant-Water-Fertilizer and Fertilizer Analysis by P K Gupta

Weed Management

Subject Code: BAGE2- 703

L T P C 2 0 0 2

Unit - 1

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Weed biology and ecology. Crop weeds association, competition and allelopathy.

Unit - II

Concepts of weed prevention, control and eradication. Methods of weed control. Physical, cultural, chemical, biological and integrated weed management.

Unit - III

Herbicides: classification, formulation, advantages, disadvantages and methods of application. Introduction to adjuvants and their use in herbicides. Introduction to selectivity of herbicides. Mode of

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action and fate of herbicides in soil. Compatibility of herbicides with other agrochemicals.

Unit - IV

Weed management in major field and non cropped areas. Shift in weed flora in cropping systems. Classification, useful and harmful aspects and control measures of aquatic weeds. Problematic weeds and their control.

Books Recommended

1. Weed Management by US Walia
2. Principle of Agronomy by S.R. Reddy

Farming System & Sustainable Agriculture

Subject Code: BAGE2- 704

L T P C 2 0 0 2

Unit - 1

Farming systems: definition, principles and components. Farming System models for irrigated, dryland, situations and modules for marginal, small and large farmers. Farming systems of the world- arable, pastoral, lay farming, shifting cultivation, and ranching.

Unit - II

Agro-forestry systems Energy and fuel wood plantations. Specialized and diversified farming, family co-operative and collective farming: their occurrence, adaptations and weaknesses. Factors affecting choice of farming systems.

Unit - III

Cropping systems, their characteristics and management. Cropping patterns. Agro-ecosystem and agro-ecological zones of Punjab and India. Efficient food producing systems.

Unit - IV

Sustainable agriculture- Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures, land degradation and conservation of natural resources.

Books Recommended

1. Farming System & Sustainable Agriculture by S.R. Reddy
2. Farming System & Sustainable Agriculture by Aniket Kalhapure, Madhukar Dhonde and Balasaheb Shete

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Production Technology of Spices, Aromatic, Medicinal and Plantation Crops

Subject Code: BAGE2- 705

LT P C 2 0 0 2

Unit - 1

Important Spice crops- Ginger, Turmeric, Dill Seed, Pepper, Cardamom, Coriander, Cumin, Fennel, Celery and Fenugreek with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects and uses.

Unit - II

Aromatic crops: Mentha, Lemongrass, Citronella, Palmarosa, Vetiver and Geranium with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects and uses.

Unit - III

Medicinal plants: Dioscoria, Rauwolfia, Opium, Periwinkle, Guggal, Belladonna, Nuxvomica, Solanumnigrum, Senna, Amla, Isabgol, Coleus, Acorus and Pipli (mug) with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects and uses.

Unit - IV

Plantation crops: Coconut, Arecanut, Betelvine, Cashew, Cocoa and Coffee with special reference to their origin and distribution, adaptation, classification, growth and development in relation to environment, climatic requirements, varieties, agronomic practices for sustained production, harvesting, processing marketing and quality aspects and uses.

Books Recommended

1. Production Technology of Spices, Aromatic, Medicinal and Plantation Crops by TNAU
2. Production Technology of Spices, Aromatic, Medicinal and Plantation by Prasad S, Bhardwaj RL

Production Technology of Economic Forest Trees

Subject Code: BAGE2- 706

LT P C 2 0 0 2

Unit - I

Plantation Silviculture: native versus exotics; even-aged versus uneven-aged; monoculture versus mixed culture. Plantation technology and tending operations of economically important tree species.

Unit - II

Agroforestry concept and suitable agroforestry systems models for different regions. Economic and

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ecological aspects of agroforestry systems. Importance of superior phenotypes, their evaluation and use in plantations.

Unit - III

Climate change and forests, Forest regeneration, productivity and rotation. Desertification and rehabilitation of waste lands. Short rotation intensive management of forest plantations. Trees outside forests, energy, industrial plantation and dendro-remediation. Production and marketing of forestry produce.

Unit - IV

Forest fire and its management. Wood based industries and importance of non timber forest produce. Frame work for forestry extension: participatory rural appraisal and joint forest management.

Books Recommended

1. Transfer of Tree cultivation technologies by Dr. C.Buveneswaran, Dr. V. Sivakumar, Mr. R.S. Prasanth, IFS, Dr. N. Krishna Kumar, IFS.
2. Shifting Cultivation by L.K.Jha

Introduction to Molecular Biotechnology (Practical)

Subject Code: BAGE1- 781

LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectrophotometer and gel electrophoresis. DNA amplification using RAPD primers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Soil Survey, Classification and Mapping (Practical)

Subject Code: BAGE2- 707

LT P C 0 0 2 1

Application and use of global positioning system (GPS) for soil survey. Macro-morphological study of soils. Classification of soils developed on different land forms.

Study of base maps-cadastral maps, toposheets, aerial photographs and satellite imageries. Soil survey of project area- preparation of base maps, analysis of soil characteristics, classification of surveyed soils, mapping and report writing. Interpretation of soil survey data for land capability and crop suitability classifications. Use of geographical information system (GIS) for preparing thematic Maps

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Soil Physical & Biological Environment (Practical)

Subject Code: BAGE2- 708

LT P C 0 0 2 1

Determination of dry and wet stability of aggregates. Measurement of insitu soil bulk density and filling of soil columns with a particular bulk density. Measurement of soil porosity. Determination of consistency limits of soils. Soil moisture characteristics. Measurement of soil temperature using thermocouples. Determination of infiltration rate under different surface conditions. In situ measurement of soil moisture by neutron probe and Time Domain Reflectometry. In situ measurement of soil matric potential using tensiometers. Enumeration of soil bacteria, fungi and actinomycetes. Isolation of Rhizobium and Azotobacter and measurement of respiration rate.

Analytical Techniques in Soils, Plants, Fertilizers and Water (Practical)

Subject Code: BAGE2- 709

LT P C 0 0 6 3

Preparation of standard solutions. Collection of soil, water, plant and fertilizer samples. Analysis of soil samples for fertility and quality evaluation for field crop and orchard plantations. Analysis of irrigation water for quality appraisal. Fertilizers analysis for quality control. Soil, water and fertilizer analysis reports for recommendation purposes. Analysis of forms of nitrogen, phosphorous, potassium and sulphur in soils. Determination of DTPA-extractable micronutrients. Plant analysis for total N, P, K and micro-nutrients. Determination of CEC and AEC of soils. Nutrient adsorption and fixation capacities of soils.

Weed Management (Practical)

Subject Code: BAGE2- 710

LT P C 0 0 2 1

Identification of weeds and weed seeds. Survey of weeds in crop fields and other habitats. Preparation of weed herbarium. Computation of herbicide doses, weed control efficiency and weed index. Methods of recording weed intensity under different situations. Herbicide label information of commonly available herbicides. Herbicide application equipments and their calibration. Diagnosis of herbicide toxicity symptoms in different crops and weeds. Visits to problem areas.

Farming System & Sustainable Agriculture (Practical)

Subject Code: BAGE2- 711

LT P C 0 0 2 1

Preparation of cropping scheme and integrated farming system models for irrigated and dryland situations. Preparation of enriched Farm Yard Manure and Vermicompost. Visit to urban waste recycling unit, organic farm and model farmers' field. Preparation of farm layout plans, different intensity crop rotations and cropping schemes. Estimating crop yields. Energy budgeting in different crops and cropping systems. Working out ecological optimum crop zones. Project making exercises for establishment of crop production farms under different situations.

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Production Technology of Spices, Aromatic, Medicinal and Plantation Crops (Practical)

Subject Code: BAGE2- 712

LT P C 0 0 2 1

Identification of crops based on morphological and seed characteristics. Propagation, seed selection, seed treatment, processing and distillation techniques for different medicinal, aromatic and spice crops.

Production Technology of Economic Forest Trees (Practical)

Subject Code: BAGE2- 713

LT P C 0 0 2 1

Nursery management: propagation methods, quality planting stock, preparation of nursery and plantation schedule. Layout and establishment of agroforestry models. Estimation of tree volume and biomass; enumeration and vegetation survey. Methods of vegetation analysis: measurement of biomass and productivity. Visit to commercial plantations, wood based industries and forestry institutes.

2.Horticulture (Pomology, Olericulture &Floriculture)

Introduction to Molecular Biotechnology

Subject Code: BAGE1- 780

LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology. Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses. Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches. DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics. Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D.Watson
2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifield
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

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Nursery Management of Horticultural Crops

Subject Code: BAGE3- 701

LT P C 2 0 0 2

Unit-I

Principles of plant propagation. Seed dormancy and germination.

Unit-II

Selection of rootstock and scion. Stock scion relationship. Factors affecting propagation. Physiology of rootstock.

Unit-III

Different methods of propagation like division, cutting, layering, budding and grafting, and tissue culture. Types of Containers, media and mixtures. Propagation structures. Nursery act, quarantine and certification.

Unit-IV

Nutrient management and plant protection measures in nursery. Economics of raising fruit plant nursery.

Books Recommended

1. Fruit Growing by J.S. Bal
2. Propagation of Horticultural Crops by R.R. Sharma
3. Plant propagation by Hartman and Kester
4. Basic Horticulture by Jetender Singh

Commercial Fruit Production

Subject Code: BAGE3- 702

LT P C 2 0 0 2

Unit-I

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties, horticulture techniques, production, plant protection measures and special problems in fruits such as citrus, mango

Unit-II

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties horticulture techniques, production, plant protection measures and special problems in fruits such as, guava, apple, pear,

Unit-III

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties horticulture techniques, production, plant protection measures and special problems in fruits such as peach, plum, ber, litchi, grapes,

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Unit-IV

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties horticultural techniques, production, plant protection measures and special problems in fruits such as pomegranate, papaya, pineapple, banana, sapota, apricot and almond.

Books Recommended

1. Fruits by Ranjit Singh
2. Fruit Growing by J.S. Bal
3. Commercial Fruits by S.P. Singh
4. Post harvest handling of Fruits and Vegetable by A.S. Sandhu and J.S. Bal
5. Propagation of Horticultural Crops by R.R. Sharma

Processing and Value Addition of Horticultural Crops

Subject Code: BAGE3- 703

LT P C 2 0 0 2

Unit-I

Scope of fruit preservation industry in India, present status, constraints and prospects. Importance, principles and practices of fruit processing.

Unit-II

Maturity indices, harvesting, transportation and quality parameters of fruits. Pre and post harvest factors affecting processing quality of fruits.

Unit-III

Commercial processing technologies for fruits like mango, citrus, guava, grapes, ber, apple, pear, peach, plum, phalsa, litchi, pomegranate and papaya etc.

Unit-IV

Packing technology for export and value addition.

Books Recommended

1. Preservation of fruits and vegetables by Lal Girdhari and Siddappa Tandon
2. Home preservation of Fruits and vegetables by Nagi Malkiat

Commercial Vegetable Production

Subject Code: BAGE3- 704

LT P C 2 0 0 2

Unit-I

Role of soil, climatic and agronomic factors in vegetable production.

Unit-II

Principles of cultivation including direct sowing, nursery management, transplanting, hardening of seedlings and vegetable forcing.

Unit-III

Weeds and their control. Rotation and Intercropping in vegetable crops.

Unit-IV

Export potentiality, post harvest handling, processing, storage and marketing of vegetables.

Books Recommended

1. Vegetable crops production technology by Fageria and Dhaka
2. Vegetable crops by T.K Boss I,II,III volume.
3. A text book of Vegetable production by G.S. Saini
4. Vegetables for Tropical Regions by Prem Nath
5. Vegetable seed production principles by Prem Singh Arya
6. Hand book of vegetable crops by M.S. Dhaliwal
7. Text book of vegetable, tuber crops and spices by S.S. Thumuburaj

Vegetable Breeding and Seed Production

Subject Code: BAGE3- 705

L T P C 2 0 0 2

Unit-I

Scope of vegetable breeding and seed production. Origin, floral biology and breeding systems in vegetable crops. Germplasm resources.

Unit-II

Principles and methods of breeding self-pollinated, often cross-pollinated and cross-pollinated vegetable crops. Plant introduction, selection, hybridization population improvement, mutation and polyploidy.

Unit-III

Seed production of conventional varieties. Production of F₁ hybrids using male sterility, self-incompatibility, various sex-form sets.

Unit-IV

Methods of production of nucleus, breeder, foundation and certified seeds isolation, pollination, seed harvesting, processing and storage. Seed testing and certification. Seed Act. Vegetable seed industry and its problems.

Books Recommended

1. Plant breeding: Theory and Practice by V. L. Chopra
2. Seed technology by R. L. Aggrawal
3. Principles and procedures of plant breeding by Chahal and Gosal
4. Plant breeding and Genetics by B. D. Singh
5. Vegetable breeding Principles and practices by Hari Har Ram
6. Breeding cross pollinated crops by Vishnu Swarup

Forcing Techniques in Vegetable Production

Subject Code: BAGE3- 706

L T P C 2 0 0 2

Unit-I

Objectives, importance and scope of protected cultivation. Nursery raising techniques. Environmental factors. Vegetable growing media. Irrigation and fertigation. Sustainable land use systems for maximising land use efficiency in protected structures.

Unit-II

Problems of growing vegetables in protected structures, . Soil sterilization techniques.

Unit-III

Hydroponics cultivation. . Pest management in green house/glass house. Crops and varieties suitable for protected cultivation.

Unit-IV

Specific technology for raising tomato, sweet pepper, cucumber and high value crops in off season. Cladding material for protected structures - use of mulches. Seed production of vegetables.

Books Recommended

1. Vegetable forcing by Ralph L.Watts
2. Production technologies of vegetable crops by Fageria and Dhaka
3. Protected Cultivation of vegetable crops by Balraj

Commercial Floriculture and Landscaping

Subject Code: BAGE3- 707

LT P C 2 0 0 2

Unit-I

Scope, importance and export potential of floriculture, environment factors influencing plant growth and flower production in cut flowers.

Unit-II

Production technology including varieties, propagation, soil, nutrition, disease and pests of important cut flowers (Rose, Gladiolus, Carnation, Gerbera and Chrysanthemum. Post harvest handling, grading and packing cut flowers, pot and bedding plants.

Unit-III

Flower seed production. History of gardening, characteristics of Hindu, Mughal , Japanese and English gardens. Principle groups of plants like trees, shrubs, climbers, shade loving plants, ground covers, their analysis and use in landscape composition.

Unit-IV

Principles of landscaping. Preparation of landscape plans for homes, farm complexes, small parks and institutions. Development and maintenance of rock, water and terrace gardens. Bonsai gardens, project formulation and evaluation.

Books Recommended

1. Beautiful gardens by M.S. Randhawa
2. Introduction to Floriculture by Roy A. Larson
3. Complete Gardening in India by K.S. Gopalswamienger
4. Floriculture at Glance by Raj D.
5. Flowering shrubs for seasonal Ornaments by S.K. Bhattacharjee

Introduction to Molecular Biotechnology (Practical)

Subject Code: BAGE1- 781

LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectrophotometer and gel electrophoresis. DNA amplification using RAPD primers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Nursery Management of Horticultural Crops(Practical)

Subject Code: BAGE3- 708

LT P C 0 0 2 1

Raising of root stock. Methods to break seed dormancy. Propagation techniques. Lifting and packing of nursery plants. Preparation of media and mixtures, and raising nursery in poly bags. Project formulation after valuation of nursery raising.

Commercial Fruit Production (Practical)

Subject Code: BAGE3- 709

LT P C 0 0 2 1

Identification of species and fruit varieties, training and pruning, maturity standards, harvesting, handling, grading and packing of fruits. Project formulation and valuation for orchard management.

Processing and Value Addition of Horticultural Crops (Practical)

Subject Code: BAGE3- 710

LT P C 0 0 2 1

Judging of maturity of different fruits. Methods of preparation of jam, jelly, ready to serve, squash, nectar, canning, chutney, pickle and marmalade etc. Packing technologies. Drying and dehydration of fruits. Visit to local processing unit.

Commercial Vegetable Production (Practical)

Subject Code: BAGE3- 711

LT P C 0 0 2 1

Sowing and transplanting of vegetable crops. Effect of soil conditions on seedling emergence and plant growth. Nutrient deficiency symptoms. Common weeds, their identification and control. Project formulation and evaluation for vegetable nursery production and vegetable forcing techniques.

Vegetable Breeding and Seed Production (Practical)

Subject Code: BAGE3- 712

LT P C 0 0 2 1

Study of inflorescence and flower structures. Practice in emasculation and artificial pollination. Inspection and rouging. Testing of seeds for purity and germination. Project formulation and evaluation for seed production of vegetable crops.

Forcing Techniques in Vegetable Production (Practical)

Subject Code: BAGE3- 713

LT P C 0 0 2 1

Study of various types of structures. Methods to control temperature, CO₂, light. Demonstration for sanitation measures. Hydroponics. Maintenance of parental lines and hybrid seed production in glasshouse. Fertigation and nutrient management. Control of diseases and insect pests in

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glasshouse. Visit to established greenhouses in the region.

Commercial Floriculture and Landscaping (Practical)

Subject Code: BAGE3- 714

LT P C 0 0 2 1

Planning and layout of gardens. Identification of planting material and commercial varieties of flowers. Seed collection, germination tests and storage. Harvesting and post harvest handling of cut flowers. Judging of flowers and pot plants. Visit to local nurseries and florist centers

3. Crop Improvement (Plant Breeding , Genetics and Biotechnology)

Introduction to Molecular Biotechnology

Subject Code: BAGE1- 780

LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology. Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses. Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches. DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics. Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D. Watson
2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifield
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Genetics of Crop Plants

Subject Code: BAGE4- 701

LT P C 2 0 0 2

Unit-I

Genetic analysis in different systems. Genetic recombination in prokaryotes and eukaryotes. Genetic material - organization, structure and replication.

Unit-II

Genetics of qualitative traits. Detection and estimation of linkage from test cross and F₂ data. Extra nuclear inheritance.

Unit-III

Genetics of quantitative traits. Genetic equilibrium and forces changing gene frequency. Induction, detection

and uses of mutations.

UNIT-IV

Gene function. Gene expression. Gene regulation. Environmental influence on gene expression. Gene cloning. Genetic transformation.

Books Recommended:

1. Fundamentals of Genetics by G.S. Miglani
2. Fundamentals of Genetics by B.D.Singh
3. Genetics by P.K. Gupta
4. Principles of Genetics by E.J. Gardner and M.J. Simmons
5. Laboratory Exercises in Genetics by G.S. Miglani, D.R. Satija and Sudagar Singh

Cytogenetics of Crop Plants

Subject Code: BAGE4- 702

LT P C 2 0 0 2

Unit-I

Structure and function of cell organelles. Cell cycle.

Unit-II

Chromosomal theory of inheritance. Morphology, ultra-structure and differential staining of chromosomes. Unusual chromosomes. Cytological, genetic and morphological effects of chromosomal aberrations.

Unit-III

Classification, induction, characterization and utilization of haploids, euploids and aneuploids. *In situ* hybridization. Evolution of karyotype.

Unit-IV

Genome analysis in wheat, cotton, Brassica species.

Books Recommended:

1. Elements of Cytology by N.S. Cohn
2. Cytogenetics by P.K. Gupta
3. Plant Cytogenetics by Ram J Singh

Theory and Practice of Plant Breeding

Subject Code: BAGE4- 703

LT P C 3 0 0 3

Unit-I

Role of plant breeding. Centres of origin of crop plants. Plant genetic resources and their utilization.

Unit-II

Breeding systems. Breeding methods in self-pollinated, cross-pollinated and vegetatively propagated crops and their genetic basis.

Unit-III

Heterosis and its exploitation. Male sterility and self-incompatibility. Mutation and polyploidy. Breeding for quality traits. Breeding for abiotic and biotic stresses. Wide hybridization.

Unit-IV

Procedures for the release of new varieties. Plant Variety Protection and Breeders' Rights. Seed Production Procedures and Practices

Books Recommended:

1. Principles and Procedure of Plant Breeding by G.S. Chahal and S.S. Gosal, Narosa Publishing House.

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2. Principal of Cultivar Development by Watler R. Fehr
3. Plant Breeding: Principles and Methods by B.D. Singh, Kalyani Publishers.
4. Plant Breeding: Theory and Practice by V.L. Chopra, Oxford & IBH Publishing Co. Pvt. Ltd.
5. Breeding Field Crops: Theory and Practice by V.L. Chopra, Oxford & IBH Publishing Co. Pvt. Ltd.
6. Practicals in Introductory Plant Breeding by G.S. Chahal, M.S. Gill, G.S. Nanda and S.B. Singh

Breeding of Field Crops

Subject Code: BAGE4- 704

LT P C 3 0 0 3

Unit-I

Application of genetic, cytogenetic and biotechnological techniques in crop breeding.

Unit-II

Breeding for major cereals & millets, their origin and germplasm sources: wheat, triticale, rice, maize, barley, pearl millet.

Unit-III

Breeding, their origin and germplasm sources for oilseeds and pulses: Rapeseed-mustard, soybean, groundnut, pigeonpea, moongbean, lentil and urdbean etc.; Cash crops and fodder crops: cotton, sugarcane, sorghum, barseem, oats etc.

Unit-IV

Problems and present status of crop improvement in India with emphasis on the work done in Punjab. National and International centres of crop improvement.

Books Recommended:

1. Plant Breeding: Theory and Practice by V.L. Chopra, Oxford & IBH Publishing Co. Pvt. Ltd.
2. Breeding Field Crops: Theory and Practice by V.L. Chopra, Oxford & IBH Publishing Co. Pvt. Ltd.
3. Principles and Procedure of Plant Breeding by G.S. Chahal and S.S. Gosal, Narosa Publishing House.
4. Plant Breeding: Principles and Methods by B.D. Singh, Kalyani Publishers
5. Principal of Cultivar Development by Watler R. Fehr

Crop Experimentation

Subject Code: BAGE4- 705

LT P C 1 0 0 1

Unit-I

Experiments in Plant Breeding - objectives, analysis and interpretation of results. Statistics in relation to crop experimentation.

Unit-II

Principles of experimental designs. Uniformity trials, progeny rows trials, compact family block design, completely randomized block design, randomized block design, incomplete block 145 designs.

Unit-III

Simple lattice. Augmented design. Split plot design

Unit-IV

Varietal trials over years and locations. G x E and estimation of genetic components. Analysis of co-variance. Determination of yield through its components.

Books Recommended:

1. Statistical Procedures for Agricultural Research by K A. Gomez and A.A. Gomez

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2. Statistical Methods for Agricultural Workers (Fourth Edition) by V.G. Panse and P.V. Sukhatme

Plant Tissue Culture and Transformation

Subject Code: BAGE4- 706

LT P C 2 0 0 2

Unit-I

Concepts of plant tissue culture and transformation. Various aspects of plant tissue culture. GMO's / LMO's/ transgenics.

Unit-II

Gene transfer methods. Agrobacterium mediated plant transformation. Particle gun mediated plant transformation.

Unit-III

Molecular characterization of transgenic plants using PCR, Southern and Western analysis. Bioassays with transgenic plants.

Unit-IV

Genetic engineering of crop plants for useful traits. Foods for the future. Biosafety concerns and regulatory mechanisms. Commercialization of transgenic products.

Books Recommended:

1. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
2. Plant Biotechnology by Jayabalan.
3. Methods in Plant Tissue Culture by U. Kumar.
4. Introduction to Plant Tissue Culture by M. K. Razdan.

Molecular Biotechnology and Genomics

Subject Code: BAGE4- 707

LT P C 2 0 0 2

Unit-I

Classification, properties and uses of restriction endonucleases. Characteristics and uses of plasmids in molecular biology. Recombinant DNA technology.

Unit-II

Construction and uses of genomic and cDNA libraries. Genome organization of prokaryotes and eukaryotes. Southern, Northern and Western hybridization.

Unit-III

Polymerase chain reaction. Molecular markers, their classification (PCR/Non-PCR based) and use: RFLP, AFLP RAPD, SSR, ISSR, STS, SCAR.

Unit-IV

Generation of molecular maps. DNA sequencing. Gene cloning approaches. Introduction to Omic approach, Functional genomics, proteomics and bioinformatics. Applications of biotechnology in crop improvement.

Books Recommended:

1. Elements of Biotechnology by P.K. Gupta
2. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
3. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.
4. Plant Biotechnology by Jayabalan.
5. Molecular plant Breeding by Yunbi Xu

Introduction to Molecular Biotechnology(Practical)

Subject Code: BAGE1- 781

LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectrophotometer and gel electrophoresis. DNA amplification using RAPDprimers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Genetics of Crop Plants (Practical)

Subject Code: BAGE4- 708

LT P C 0 0 2 1

Study of autosomal monogenic and digenic inheritance. Three point test cross and gene mapping. Detection and estimation of linkage using test cross and F2 data. Segregation in corn. Gene frequency analysis - autosomal, sex-linked and multiple allelic traits. Genetic equilibrium. Demonstration of quantitative inheritance.

Cytogenetics of Crop Plants (Practical)

Subject Code: BAGE4- 709

LT P C 0 0 2 1

Microscopy. Techniques of cytological preparations. Fixation of material for mitosis and meiosis. Preparation of permanent slides of cell division. Karyotype analysis. Production and study of polyploids and haploids. Identification of aneuploids.

Theory and Practice of Plant Breeding (Practical)

Subject Code: BAGE4- 710

LT P C 0 0 2 1

Emasculation, crossing and selfing in various crops. Collection, viability and germination of pollen. Handling of breeding materials. Study of variability, male sterility and selfincompatibility. Quality testing in crop plants. Screening for disease resistance.

Crop Experimentation (Practical)

Subject Code: BAGE4- 711

LT P C 0 0 2 1

Statistical parameters and tests of significance. Use of computer packages/software for data analysis. Layout of field experiments. Analysis of experimental designs. Character association. Analysis of varietal trials and G x E interactions.

Plant Tissue Culture and Transformation (Practical)

Subject Code: BAGE4- 712

LT P C 0 0 2 1

Establishment of direct and indirect *in vitro* plant regeneration methods for genetic transformation. Gene constructs and their maintenance. Agrobacterium mediated genetic transformation. Particle mediated genetic transformation. Histochemical GUS assays. PCR screening of putative transgenic plants. Raising transgenic

plants under contained conditions.

Molecular Biotechnology and Genomics (Practical)

Subject Code: BAGE4- 713

L T P C 0 0 2 1

Isolation, purification and fractionation of DNA and proteins. Isolation and purification of plasmids. Quantification of protein and nucleic acid concentration using spectrophotometer. DNA amplification using RAPD/SSR primers and its fractionation in agarose gel. Generation of linkage maps and mapping of qualitative genes using important web sites on computer.

4. Agri-Economics, Extension & Business Management

Introduction to Molecular Biotechnology

Subject Code: BAGE1- 780

L T P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology. Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses. Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches. DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics. Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D. Watson
2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifield
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Visual and Graphic Communication

Subject Code: BAGE5- 701

L T P C 1 0 0 1

Unit I

Definition, characteristics, classification, principles and role of visuals in communication; Contribution of visual perception in learning process

Unit II

Planning, preparation, presentation and evaluation of visual aids; low cost visuals, photographs and pictures

Unit III

Computer based digitized visual materials; Use of drawing techniques for visuals

Unit IV

Selection and use of animation tools in transfer of technology; Preparation and use of resource map for extension work; Designing of visuals for print and electronic media; Scope and importance of journalism

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in agriculture

Books Recommended

1. Visual Communication Design: An Introduction to Design Concepts in Everyday Experience by Meredith Davis and Jamer Hunt
2. Notes on Graphic Design and Visual Communication 3rd Edition by Gregg Berryman

Communication & Information Technology

Subject Code: BAGE5- 702

LT P C 2 0 0 2

Unit I

Introduction to communication. Problems in communication and feedback. Role of information and communication technology in agriculture and rural development

Unit II

Extension teaching methods and their use. Trends in agriculture information management system. Need and scope of cyber extension

Unit III

Importance of kiosks, agri-portal, internet café, community and FM radio in villages. Privatization of cyber extension

Unit IV

Public-private partnership. Development of Information Communication Technology (ICT) in changing the agricultural scenario.

Books Recommended

1. Information & Communication Technology (ICT) In Education Paperback – 2016 by Prof. T. Mrunalini and Prof. A. Ramakrishna
2. Information Technology Infrastructure and Its Management Paperback – 2014 by Munesh Chandra Trivedi

Behavioural Skills for Human Resource Development

Subject Code: BAGE5- 703

LT P C 2 0 0 2

Unit I

Concept of human behaviour. Taxonomy of behavioural domains. Human needs and their hierarchy. Attitude, its characteristics and measurement. Perception and its principles, selectivity in perception.

Unit II

Motivational skills for attitudinal and perceptual changes. Problem-solving skills. Innovativeness in human behaviour, response and resistance to change.

Unit III

Concept of self, Johari's window model. Defence mechanism. Group dynamics. Group behaviour

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and conflict management. Decision-making process. Theories of leadership.

Unit IV

Concept of human resource development and human relations. Human interaction, its importance and types. Interpersonal perception and social behavior

Books Recommended

- 1.Human Resource Management, 11ed, ISV Paperback – by David A. Decenzo, Stephen P. Robbins and Susan L. Verhulst
- 2.Fundamental of human resource Management by Neeru Vasishth

Micro Economic Analysis

Subject Code: BAGE5- 704

LT P C 3 0 0 3

Unit I

Micro Economics: meaning, definition, importance, nature and scope. Theory of consumer behavior: marginal utility analysis and indifference curve analysis. Demand analysis: meaning, definition, derivation of demand curve.

Unit II

Firm and industry: meaning, types, difference between firm and industry, equilibrium conditions, short-run and long-run analysis. Production: meaning, process and factors of production, relationship between production and different factors, production lags.

Unit III

Theory of producer behaviour: production function, costs, optimization of inputs use and product combinations, maximization of returns, specialization and diversification and supply analysis. Product market: meaning, types, assumptions, conditions of perfect and imperfect markets.

Unit IV

Equilibrium of a firm and industry, determination of price and output of commodities under different market situations. Factor pricing: meaning, different theories for determination of rent, wages, interest and profit.

Books Recommended

- 1.Advanced Economic Theory Paperback – by H L Ahuja
- 2.Economic Theory by Vaish and Sundharam

Macro Economic Analysis

Subject Code: BAGE5- 705

LT P C 3 0 0 3

Unit I

Macro Economics: meaning, definition, importance, limitations, scope and integration of micro and macro analysis. Basic macroeconomic concepts. National income: meaning, definition, types, measurement and social accounting

Unit II

Circular flow of money. Simple Keynesian model of income determination, shifts in aggregate

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demand. Multiplier. Theories of consumption and investment. Income determination model including money and interest. Monetary policy: meaning, instruments, indicators, lags and effectiveness

Unit III

Fiscal policy: meaning, definition, different tools and limitations. Wage and employment policies: meaning, need, demand and supply of labour, measures of full employment, relationship between level of employment and output. Inflation and recession: process, causes, types and remedies

Unit IV

Introduction to Indian economy and comparison with other related economies. Significant economic problems in Indian agriculture relating to agricultural production and productivity, credit, marketing, labour and environment

Books Recommended

1. Economic Theory by Vaish and Sundharam
2. A text book of economic theory by Stonier and Hague
3. Macroeconomic Analysis Hardcover – by Edward Shapiro

Financial & Project Management

Subject Code: BAGE5- 706

L T P C 3 0 0 3

Unit I

Importance, need, scope and functions of finance. Concept of time value of money. Capital budgeting concept and steps in capital budgeting

Unit II

Appraisal criteria- payback period, average rate of return, net present value, benefit cost ratio and internal rate of return.

Unit III

Working Capital Management- concept, determinants and need for working capital in agribusiness. Introduction, objectives and techniques of inventory management for agribusiness.

Unit IV

Introduction to cost of capital and capital structure. Project management- concept, characteristics and types of projects. Project feasibility- market, technical, financial and economic feasibility. Project risk analysis. Estimating financial requirements of projects and sources of finance.

Books Recommended

1. Project Appraisal & Management by Rashmi Agrawal Yogieta S
2. Financial Management by R.P Rustagi

Retailing and Supply Chain Management

Subject Code: BAGE5- 707

L T P C 3 0 0 3

Unit I

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Introduction to retailing- definition, concept and overview. Types of retail institutions related to agri- business. Changing food consumption patterns in India.

Unit II

Store location and site selection. Managing retail operations procurement and inventory management. Store design- the exterior, interior, layout and display.

Unit III

Promoting store. Introduction to customer relationship management in retail business.

Unit IV

Supply chain management concept, definition and importance. Elements of physical distribution systems, building and operating supply chains in agribusiness. Role of IT in supply chain management

Books Recommended

1. Managing the Retail Supply Chain by Glenn Taylor and James Topps
2. Retail Supply Chain Management by James Ayers and Mary Ann Odegaard

Introduction to Molecular Biotechnology(Practical)

Subject Code: BAGE1- 781

LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectrophotometer and gel electrophoresis. DNA amplification using RAPD primers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Visual and Graphic Communication (Practical)

Subject Code: BAGE5- 708

LT P C 0 0 2 1

Preparation and use of visual aids. Generating computer aided presentation of graphics. Scanning of visuals, image editing and script writing for radio & TV. Developing agricultural video films. Visit to animation, print and electronic media centers. Writing of news items, articles, success stories etc. for print and electronic media. Presentation and evaluation of visuals.

Communication & Information Technology (Practical)

Subject Code: BAGE5- 709

LT P C 0 0 2 1

Studying problems faced by farmers at Agri-clinic and analyzing communication problems of extension personnel. Use of different extension teaching methods in field and simulated conditions. Practice in planning and conducting video- conferencing. Visit to information kiosks. Identifying problems in agriculture information management system.

Micro Economic Analysis (Practical)

Subject Code: BAGE5- 710

LT P C 0 0 2 1

Practical training to study consumer behavior in relation to demand of various commodities, consumer survey. Economic analysis of a firm and industry. Working knowledge of relationship between production and different factors of production, production costs and optimum input use. Product market survey. Practical training of price determination in different types of markets

Financial & Project Management (Practical)

Subject Code: BAGE5- 711

LT P C 0 0 2 1

Case studies related to financial management and project management. Visits to agri-business industrial houses. Numerical problems based on capital budgeting. Preparation of project report for various agri-business ventures

5.Plant Protection (Entomology, Plant Pathology and Nematology)

Introduction to Molecular Biotechnology

Subject Code: BAGE1- 780

LT P C 2 0 0 2

Unit-I

History, definitions, concepts, scope and importance of Biotechnology. Genome organization in prokaryotes and eukaryotes. Restriction endonucleases, their properties and uses. Vectors, their types and use.

Unit-II

DNA ligation. Nucleic acid hybridization. Polymerase Chain Reaction its variants. Gene cloning and its approaches. DNA sequencing.

Unit-III

Recombinant DNA technology. Genetic Engineering and Transgenics. Biosafety guidelines for GMOs

Unit-IV

Uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding.

Books Recommended:

1. Molecular biology of gene, J.D. Watson
2. Gene VIII, Benjamin Lewin
3. Molecular biology, David Freifield
4. Elements of Biotechnology by P.K. Gupta
5. Introduction to Plant Biotechnology by H.S. Chawla, Science Publishers.
6. Gene Cloning and DNA Analysis by T.A. Brown, Wiley- Blackwell.

Apiculture

Subject Code: BAGE6- 701

LT P C 1 0 0 1

Unit-I

Indian history of beekeeping. Species and races of honey bees. Morphology and anatomy of honey bee.

Unit-II

Colony organization, life cycle and division of labour in *Apis mellifera*. Seasonal management of honey bee colonies; swarming, drifting and curbing drone population.

Unit-III

Management of queenless and laying worker colonies. Colony multiplication. Bee enemies and diseases. Protection from pesticidal hazards. Maximizing honey production. Bee flora.

Unit-IV

Managed bee pollination of crops. Colony migration. Apicultural diversification. Honey and its quality. Economics of beekeeping.

Books Recommended

1. Integrated pest management by G. S. Dhaliwal
 2. Biopesticides and pest management by G. S. Dhaliwal
 3. A text book of applied Entomology by K. P. Srivastava
 4. Agricultural insect pests of Crops and their control by V. P. S. Panwal
- Hand book of Pest management by S. F. Hameed

Biocontrol and Integrated Pest Management

Subject Code: BAGE6- 702

LT P C 2 0 0 2

Unit-I

History and concept of biological control, different groups of biological control agents and biopesticides: macrobials (parasitoids and predators), microbials (bacteria, viruses, fungi, protozoa and nematodes) and botanical- neem, pyrethrum, nicotine, rotenone and others, their use in pest management along with advantages and limitations.

Unit-II

Methods of mass production for each of these groups. National and international agencies dealing with biological control. IPM-history, definition and concept. Concept of economic threshold. Pest monitoring and surveillance.

Unit-III

Different tools of IPM including physical, mechanical, cultural, biological (parasite and predators, microbial agents), host plant resistance, botanical, chemical, biorationals and biotechnological approaches. Integration of different IPM tactics.

Unit-IV

Decision making systems. Potential of IPM, its implementation and constraints. Successful

example inIPM.

Books Recommended

1. Applied Entomology by D.K. Verma
2. Applied Entomology by M. Yadav
3. Essentials of Agricultural Entomology by G. S. Dhaliwal
4. Entomology by M.S. Nalina Sundar
5. Insects Pests of cereal and their Management by Sandhya Aggarwal

Pesticides and Plant Protection Equipment

Subject Code: BAGE6- 703

LT P C 2 0 0 2

Unit-I

Pesticides- classification, properties, entry and mode of action. Formulations and toxicity of pesticides.

Unit-II

Factors affecting toxicity of pesticides. Compatibility and synergism. Antidotes. Problems associated with the use of pesticides.

Unit-III

Role of repellents, attractants, pheromones, hormones, chemosterilants and antifeedants in pest control.

Unit-IV

Pest control equipment - history of development, classification, constructional features, principles of working, operation, maintenance and selection. Planning of pest control operations.

Books Recommended

1. Text Book of applied Entomology I by K. P. Srivastava
2. Text Book of applied Entomology II by K. P. Srivastava
3. Bio pesticides and Pest Management by G. S. Aulakh
4. Atwal A.S.& G.S.Dhaliwal by *Insect Pests of South East Asia*, Kalyani Publishers, New Delhi

Biocontrol and Integrated Disease Management

Subject Code: BAGE6- 704

LT P C 2 0 0 2

Unit-I

History and principles underlying host resistance, chemical, physical, cultural, biological and legislative measures of plant disease management.

Unit-II

Scope and factors affecting biological control. Mechanisms of bio-control. Characterization of bioagents and their commercial formulations. Limitations of biocontrol.

Unit-III

Commercial production and distribution system. Integrated disease management. Historical

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developments and classification of fungicides and antibiotics. Mode of action, uptake, translocation, disease control and factors affecting their efficacy and field performance. Registration, commercial development and compatibility of fungicides with other chemicals.

Unit-IV

General account of plant protection appliances. Development of resistance in pathogens against fungicides. Non-target effects of fungicide use. Methods of screening for disease resistance. Seed certification standards and phytosanitary measures.

Books Recommended

1. Text Book of applied Entomology I by K. P. Srivastava
2. Text Book of applied Entomology II by K. P. Srivastava
3. Bio pesticides and Pest Management by G. S. Aulakh

Post Harvest Diseases and their Management

Subject Code: BAGE6- 705

LTPC 2002

Unit-I

Importance of post-harvest diseases. Important post-harvest diseases of fruits and vegetables.

Unit-II

Factors affecting ripening of fruits and vegetables. Factors favoring development of post-harvest diseases.

Unit-III

Effect of handling and storage practices on the development of post-harvest diseases. Storage methods and conditions.

Unit-IV

Disease management strategies for post-harvest diseases.

BOOKS RECOMMENDED

1. Introductory Mycology by Alexopoulos,
2. Fungi and Plant Diseases by Mundkur, C.T. B.B. & Chattopadhyaya, SB
3. Plant Diseases by R.S. Singh
4. Plant Pathology by R.P. Singh
5. Fungi by G.L. Chopra
6. Plant Pathology by B.P. Pandey

Plant Nematology

Subject Code: BAGE6- 706

LTPC 1001

Unit-I

History and economic importance of plant parasitic nematodes. General characteristics, identification, their classification and relationship with other organisms.

Unit-II

Morphology and biology of important genera, namely Meloidogyne, Heterodera, Globodera, Anguina, Rotylenchulus, Ditylenchus,

Unit-III

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Morphology and biology of important genera, namely Tylenchulus, Pratylenchus, Radopholus and virus vectors.

Unit-IV

Principles and methods of control.

Books recommended

1. Plant Nematology: R. N. Perry and M. Moens (2013, 2nd Edition)
2. Plant parasitic nematodes in temperate agriculture: K. Evans, D. Trudgill and J. Webster (1993)
3. Plant parasitic nematodes in subtropical and tropical agriculture: R. Sikora, D. Coyne, J. Hallmann and P. Timper (2018, 3rd Edition)
4. Practical plant nematology: A field and laboratory guide: D. Coyne, J. Nicol and B. Claudius-Cole

Introduction to Molecular Biotechnology (Practical)

Subject Code: BAGE1- 781

LT P C 0 0 2 1

Preparation of competent cells and transformation. Isolation, purification and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Quantification of nucleic acids concentration using dot blot method, spectrophotometer and gel electrophoresis. DNA amplification using RAPD primers and its fractionation on agarose gel. DNA amplification using microsatellite primers and its fractionation using polyacrylamide gels. Estimation of genetic similarities and generation of dendrograms using NTSYS/DARwin software. Introduction to various databases.

Plant Disease Diagnosis (Practical)

Subject Code: BAGE6- 707

LT P C 0 0 4 2

Field diagnosis of important diseases of Rabi and Kharif crops, vegetables, fruits, forest and ornamental plants. Estimation of losses and methods for assessing the intensity of diseases like angular leaf spot of cotton, Tikka disease of groundnut, yellow mosaic of beans, downy mildew of bajra, rusts and loose smut of wheat, Alternaria blight, downy mildew of mustard and powdery mildew of pea. Methods of soil sterilization for raising healthy nursery plants. Solar-heat treatment. Methods of producing virus-free citrus and potato. Diagnosis and differentiation of disorders due to viruses, nutritional imbalances, genetic variations and toxaeimias. Types of chemicals used for the control of plant diseases and methods of their application. Cultural and biological methods of plant disease control.

Apiculture (Practical)

Subject Code: BAGE6- 708

LT P C 0 0 4 2

Important species of honey bees, castes differentiation and body structure. Handling of colonies. Colony organization and food storage pattern. Langstroth hive, apicultural equipment and machinery. Bee flora. Seasonal management practices. Colony division. Mass queen bee rearing techniques. Queen introduction, clipping and marking. Bee pollination of crops. Management of

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bacterial, viral and fungal diseases of honey bees. Identification and management of parasitic mites, wax moths, ants, wasps and predatory birds. Honey extraction. Pollen, propolis and bee venom collection. Processing of bees wax. Royal jelly production and collection. Honey processing and packaging. Honey testing. Visit to beekeeping industry (Hive manufacturing, equipment manufacturing, honey processing and exporting commercial units).

Biocontrol and Integrated Pest Management(Practical)

Subject Code: BAGE6- 709

LT P C 0 0 4 2

Identification of important groups of parasitoids, predators and microbial control agents. Laboratory multiplication of parasitoids, predators and microbial control agents. Determination of economic threshold 100 levels. Demonstration of cultural and mechanical control measures of different pests. Use of pheromones, colour, sticky and light traps for monitoring and surveillance of pests. Study of IPM module in cotton, rice, sugarcane, maize, fruits and vegetables

Pesticides and Plant Protection Equipment (Practical)

Subject Code: BAGE6- 710

LT P C 0 0 2 1

Familiarization with different formulations of pesticides, their preparation and use. Toxicity to insects and plants. Calculation of dosages of pesticides and fumigants. Practice in the use of various types of pest-control equipments. Study of factors affecting efficacy of pesticide spray. Calibration of plant protection equipments. Common troubles in the use of pest-control equipment and their remedies. Estimation of pesticide residue in food commodities.

Biocontrol and Integrated Disease Management (Practical)

Subject Code: BAGE6- 711

LT P C 0 0 4 2

Isolation and Identification of bio-control agents. Evaluation of bio-control agents against plant pathogens in vitro and in vivo. Production and application procedures. Laboratory evaluation of fungicides and antibiotics by various methods against different groups of pathogens. Methods of application of fungitoxicants. Absorption, translocation and persistence of different fungitoxicants. Integration of bio-control agents with other methods of plant disease control.

Post Harvest Diseases and their Management (Practical)

Subject Code: BAGE6- 712

LT P C 0 0 2 1

Important post-harvest diseases of fruits and vegetables like mango, citrus, guava, grapes, pear, cucurbits, chilli, tomato and potato. Study of factors favouring development of post-harvest diseases. Disease development under different storage conditions. Demonstration of various methods of disease management. Visit to a packing house.

Plant Nematology (Practical)

Subject Code: BAGE6- 713

LTPC 0021

Methods of survey, collection of soil and plant samples. Extraction of nematodes and population estimation. Preparation of temporary and permanent mounts. Study of morphological characteristics and disease symptoms. Application of nematicides.

MRSPU

Eight Semester

On-campus learning

Subject Code: BAGE1- 880

LT P C 0 0 16 8

After attaining the rural experience, for about 12 weeks, on-campus learning will be planned. Detailed Practical Field Learning Programme of each specialization is given below;

Industrial attachments (Off-campus)

Subject Code: BAGE1- 881

LT P C 0 0 10 5

Students from each stream will be divided into groups each having 5 to 10 students and each group will visit an agro-industrial (processing) unit with the help of extension agencies and prepare a report of the organizational set-up, operational working and performance of the unit with SWOT analysis. Next 4 weeks are to be devoted to this activity.

Rural experiences

Subject Code: BAGE1- 882

LT P C 0 0 6 3

A coordinator from the department of Extension Education will handle this course. For practically showing, he will take the students to an average village and make them aware the socio-economic structure of the villager such as sources of livelihood and occupational pattern, village infrastructure in terms of health, education, vety services, cooperative societies, banks, marketing facilities, farming conditions with reference to cropping pattern & livestock situation etc. The time allocated to this activity is three weeks in the beginning of semester.

Documentation, reporting and presentation

Subject Code: BAGE1- 883

LT P C 0 0 2 1

Each group of students will write a detailed report of their rural and specialized practical training taken and give a Power Point Presentation in the presence of concerned teachers who will evaluate the performance of the students. It will be completed in one week.

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Details of On-campus and off-campus Practical Field Learning Programme

Title of Module (on-campus)	Industrial attachment (Off-campus)
1.Natural Resource Management (Soil , Agronomy &Agro-forestry	
Module for evaluating soil health and irrigation water quality (Deptt. of Soil Science)	<ul style="list-style-type: none"> • Fertilizer industries • Vermi-compost units • Bio-fertilizer units • Mineral mines • Organic Farming
Practical seed production (Deptt. of Agronomy)	<ul style="list-style-type: none"> •Seed industries / companies • Herbicide formulators • Agro-processing units such as Mentha distillation plants, Soybean processing units, Rice Shelling, Sugar Mill
2.Horticulture (Pomology, Olericulture &Floriculture)	
Nursery production of fruit crops (Deptt. of Fruit Science)	Commercial fruit nurseries Orchards of Progressive growers
Nursery raising techniques and protected cultivation of Vegetables (Deptt. of Vegetable Science)	Commercial vegetable nurseries Farms of Progressive vegetable and flower growers
Mushroom production (Deptt. of Microbiology)	Vegetables seed production units Mushroom production units
3. CROP IMPROVEMENT (Plant Breeding, Genetics and Biotechnology)	
Hybrid seed production of sunflower	Commercial hybrid seed production units Maintaining parental lines Hybrid Seed production units at private farm
Biotechnological tools in crop improvement	Biotechnological and tissue culture labs
Breeder seed production	Breeding material and varietal trials

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4. Agri-Economics, Extension & Business Management

<p>Designing and preparation of facilitating material and organizing activities (Deptt. of Extension Education)</p>	<ul style="list-style-type: none"> • Mandate, activities and problems of extension services provided by extension system of Agriculture, Horticulture, AH, Soil Conservation, PAMETI, ATMA, IFFCO, KRIBHCO, MARKFED, DRDA, Zila Prishad etc.
<p>Marketing of agricultural produce, preparing enterprise & financial budgets and identification of adoption gaps (Deptt. of Agric. Economics)</p>	<ul style="list-style-type: none"> • Structure & functioning of Agricultural Financial Institutions - Commercial Banks, Co-operative Societies • Market channels and functionaries in foodgrain/vegetable market • Estimating economics of crop and livestock enterprises, preparing project reports
<p>Case studies related to financial, project, retail and supply chain management, and preparation of project profile (Deptt. of Business Management)</p>	<ul style="list-style-type: none"> • Study of Successful ventures of Agri-management such as milk plant and associated dairy units, poultry farms, mushroom/fruit/vegetable/ flower units for project evaluation and marketing
<p align="center">Elective: 5.Plant Protection (Entomology, Plant Pathology and Nematology)</p>	
<p>Production of bio-agents against plant pathogens (Deptt. of Plant Pathology/ Entomology)</p>	<ul style="list-style-type: none"> • Pesticide and bio-pesticide industries • Bio-control agents production units • Plant Quarantine Station • Virus free potato tubers production units