Compulsory Courses for all streams of VII semester

8 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-701	Diseases of Field Crops & their Management	2	0	0	40	60	100	2
BSAG-702	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BSAG- 703	Diseases of Field Crops & their Management (Practical)	0	0	2	20	30	50	1
BSAG- 704	Introduction to Molecular Biotechnology (Practical)	0	0	2	20	30	50	1
	Total	4	0	4	120	180	300	6

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

Elective Specialized Courses

1. **Crop Science (Soil , Agronomy& Agro-forestry)**

30 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-CS701	Soil Physical and Biological Environment	2	0	0	40	60	100	2
BSAG-CS702	Analytical Techniques in Soils, Plants, Fertilizers and Water	2	0	0	40	60	100	2
BSAG-CS703	Weed Management	2	0	0	40	60	100	2
BSAG-CS704	Farming Systems and Sustainable Agriculture	2	0	0	40	60	100	2
BSAG-CS705	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops	2	0	0	40	60	100	2
BSAG-CS706	Production Technology of Economic Forest Trees	2	0	0	40	60	100	2
BSAG-CS707	Soil Survey, Classification and Mapping (Practical)	0	0	2	20	30	50	1
BSAG-CS708	Soil Physical and Biological Environment (Practical)	0	0	2	20	30	50	1
BSAG-CS709	Analytical Techniques in Soils, Plants, Fertilizers and Water (Practical)	0	0	6	60	90	150	3
BSAG-CS710	Weed Management (Practical)	0	0	2	20	30	50	1
BSAG-CS711	Farming Systems and Sustainable Agriculture (Practical)	0	0	2	20	30	50	1
BSAG-CS712	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops (Practical)	0	0	2	20	30	50	1
BSAG-CS713	Production Technology of Economic Forest Trees (Practical)	0	0	2	20	30	50	1
	Total	12	0	18	420	630	1050	21

Elective Specialized Courses

2. Horticulture (Pomology, Olericulture & Floriculture)

28 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-HC701	Nursery Management of Horticultural Crops	2	0	0	40	60	100	2
BSAG-HC702	Commercial Fruit Production	2	0	0	40	60	100	2
BSAG-HC703	Processing and Value Addition of Horticultural Crops	2	0	0	40	60	100	2
BSAG-HC704	Commercial Vegetable Production	2	0	0	40	60	100	2
BSAG-HC705	Vegetable Breeding and Seed Production	2	0	0	40	60	100	2
BSAG-HC706	Forcing Techniques in Vegetable Production	2	0	0	40	60	100	2
BSAG-HC707	Commercial Floriculture and Landscaping	2	0	0	40	60	100	2
BSAG-HC708	Nursery Management of Horticultural Crops (Practical)	0	0	2	20	30	50	1
BSAG-HC709	Commercial Fruit Production (Practical)	0	0	2	20	30	50	1
BSAG-HC710	Processing and Value Addition of Horticultural Crops (Practical)	0	0	2	20	30	50	1
BSAG-HC711	Commercial Vegetable Production (Practical)	0	0	2	20	30	50	1
BSAG-HC712	Vegetable Breeding and Seed Production (Practical)	0	0	2	20	30	50	1
BSAG-HC713	Forcing Techniques in Vegetable Production (Practical)	0	0	2	20	30	50	1
BSAG-HC714	Commercial Floriculture and Landscaping (Practical)	0	0	2	20	30	50	1
	Total	14	0	14	420	630	1050	21

Elective Specialized Courses

3. Plant Breeding, Genetics & Biotechnology

27 Hrs

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-PGB701	Genetics of Crop Plants	2	0	0	40	60	100	2
BSAG-PGB 702	Cytogenetics of Crop Plants	2	0	0	40	60	100	2
BSAG- PGB 703	Theory and Practice of Plant Breeding	3	0	0	60	90	150	3
BSAG- PGB 704	Breeding of Field Crops	3	0	0	60	90	150	3
BSAG- PGB 705	Crop Experimentation	1	0	0	20	30	50	1
BSAG- PGB 706	Plant Tissue Culture and Transformation	2	0	0	40	60	100	2
BSAG- PGB 707	Molecular Biotechnology and Genomics	2	0	0	40	60	100	2
BSAG- PGB708	Genetics of Crop Plants (Practical)	0	0	2	20	30	50	1
BSAG- PGB 709	Cytogenetics of Crop Plants (Practical)	0	0	2	20	30	50	1
BSAG- PGB 710	Theory and Practice of Plant Breeding(Practical)	0	0	2	20	30	50	1
BSAG- PGB 711	Crop Experimentation (Practical)	0	0	2	20	30	50	1
BSAG- PGB 712	Plant Tissue Culture and Transformation (Practical)	0	0	2	20	30	50	1
BSAG- PGB 713	Molecular Biotechnology and Genomics (Practical)	0	0	2	20	30	50	1
	Total	15	0	12	420	630	1050	21

Elective Specialized Courses

4. Agri-extension, Economics & Business Management

25 Hrs

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-AEB701	Visual and Graphic Communication	1	0	0	20	30	50	1
BSAG- AEB 702	Communication and Information Technology	2	0	0	40	60	100	2
BSAG- AEB 703	Behavioural Skills for Human Resource Development	2	0	0	40	60	100	2
BSAG- AEB 704	Micro Economic Analysis	3	0	0	60	90	150	3
BSAG- AEB 705	Macro Economic Analysis	3	0	0	60	90	150	3
BSAG- AEB 706	Financial and Project Management	3	0	0	60	90	150	3
BSAG- AEB 707	Retailing and Supply Chain Management	3	0	0	60	90	150	3
BSAG- AEB708	Visual and Graphic Communication (Practical)	0	0	2	20	30	50	1
BSAG- AEB 709	Communication and Information Technology (Practical)	0	0	2	20	30	50	1
BSAG- AEB 710	Micro Economic Analysis (Practical)	0	0	2	20	30	50	1
BSAG- AEB 711	Financial and Project Management (Practical)	0	0	2	20	30	50	1
	Total	17	0	8	420	630	1050	21

Elective Specialized Courses

5. Plant Protection

32 Hrs

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-PP701	Apiculture	1	0	0	20	30	50	1
BSAG- PP 702	Biocontrol and Integrated Pest Management	2	0	0	40	60	100	2
BSAG- PP 703	Pesticides and Plant Protection Equipment	2	0	0	40	60	100	2
BSAG- PP 704	Biocontrol and Integrated Disease Management	2	0	0	40	60	100	2
BSAG- PP 705	Post Harvest Diseases & their Management	2	0	0	40	60	100	2
BSAG- PP 706	Plant Nematology	1	0	0	20	30	50	1
BSAG- PP 707	Plant Disease Diagnosis (Practical)	0	0	4	40	60	100	2
BSAG- PP708	Apiculture (Practical)	0	0	4	40	60	100	2
BSAG- PP 709	Biocontrol and Integrated Pest Management (Practical)	0	0	4	40	60	100	2
BSAG- PP 710	Pesticides and Plant Protection Equipment (Practical)	0	0	2	20	30	50	1
BSAG- PP 711	Biocontrol and Integrated Disease Management (Practical)	0	0	4	40	60	100	2
BSAG- PP 712	Post Harvest Diseases & their Management (Practical)	0	0	2	20	30	50	1
BSAG- PP 713	Plant Nematology (Practical)	0	0	2	20	30	50	1
	Total	10	0	22	420	630	1050	21

Compulsory Courses for all streams of VII semester

8 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-701	Diseases of Field Crops & their Management	2	0	0	40	60	100	2
BSAG-702	Introduction to Molecular Biotechnology	2	0	0	40	60	100	2
BSAG- 703	Diseases of Field Crops & their Management (Practical)	0	0	2	20	30	50	1
BSAG- 704	Introduction to Molecular Biotechnology (Practical)	0	0	2	20	30	50	1
	Total	4	0	4	120	180	300	6

BSAG-701 Diseases of Field Crops & their Management

Economic importance, symptoms, causal organism, epidemiology, disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, barley, sugarcane, turmeric, tobacco, groundnut, sesamum, castor, sunflower, rapeseed & mustard, cotton, pulses, mentha and berseem.

BSAG-702 Introduction to Molecular Biotechnology

Genome organization of prokaryotes and eukaryotes; Restriction endonucleases- classification, properties and uses in molecular biology; Recombinant DNA technology; Construction and uses of genomic and cDNA libraries; Southern, Northern and Western Hybridization; RFLPs; Polymerase Chain Reaction and its variants; PCR based markers like RAPDs, SSRs, AFLPs, SNPs and their variants; uses of molecular markers in generation of molecular linkage maps, gene mapping and marker assisted breeding; DNA sequencing; gene cloning approaches.

BSAG-703 Diseases of Field Crops & their Management (Practical)

Study of symptoms and host-parasite relationships of important diseases of field crops. Field visits at appropriate time during the semester.

BSAG-704 Introduction to Molecular Biotechnology (Practical)

Preparation of competent cells and Transformation. Isolation and purification of and fractionation of plant DNA. Agarose and PAGE Gel electrophoresis. Measurement of nucleic acids concentration using photospectometer and gel electrophoresis. DNA amplification using RAPD primers and its fractionation in 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.

---

1. **Crop Science (Soil , Agronomy& Agro-forestry)**

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-CS701	Soil Physical and Biological Environment	2	0	0	40	60	100	2
BSAG-CS702	Analytical Techniques in Soils, Plants, Fertilizers and Water	2	0	0	40	60	100	2
BSAG-CS703	Weed Management	2	0	0	40	60	100	2
BSAG-CS704	Farming Systems and Sustainable Agriculture	2	0	0	40	60	100	2
BSAG-CS705	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops	2	0	0	40	60	100	2
BSAG-CS706	Production Technology of Economic Forest Trees	2	0	0	40	60	100	2
BSAG-CS707	Soil Survey, Classification and Mapping (Practical)	0	0	2	20	30	50	1
BSAG-CS708	Soil Physical and Biological Environment (Practical)	0	0	2	20	30	50	1
BSAG-CS709	Analytical Techniques in Soils, Plants, Fertilizers and Water (Practical)	0	0	6	60	90	150	3
BSAG-CS710	Weed Management (Practical)	0	0	2	20	30	50	1
BSAG-CS711	Farming Systems and Sustainable Agriculture (Practical)	0	0	2	20	30	50	1
BSAG-CS712	Production Technology of Spices, Aromatic, Medicinal and Plantation Crops (Practical)	0	0	2	20	30	50	1
BSAG-CS713	Production Technology of Economic Forest Trees (Practical)	0	0	2	20	30	50	1
	Total	12	0	18	420	630	1050	21

BSAG-CS701 Soil Physical & Biological Environment

Soil physical properties in relation to crop production. Soil thermal regime and its management. 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. Evaporation from soils and its management. Runoff from the agricultural fields and factors affecting. Soil organisms and their distribution, ecology, classification and activities in soil. Microbiological transformations of C, N and S in soils.

BSAG-CS702 Analytical Techniques in Soils, Plants, Fertilizers and Water

Colorimetric and flame photometric methods. Atomic absorption spectrophotometry. Cation and anion exchange phenomenon and their importance. Ion adsorption, desorption and fixation in soils. Methods of soil fertility evaluation. Fertilizer control order. Acid, saline, sodic, calcareous soils and their amelioration. Planning and formulation of project on establishment of soil water and plant testing laboratory.

BSAG-CS703 Weed Management

Weeds- Introduction, harmful and beneficial effects, characteristics and classification. Weed biology and ecology. Crop weed association, competition and allelopathy. Concepts of weed prevention, control and eradication. Methods of weed control. Physical, cultural, chemical, biological and integrated weed management. Herbicides- classification, formulation, advantages, disadvantages and methods of application. Introduction to adjuvants and their use in herbicides. Introduction to selectivity of herbicides. Mode of action and fate of herbicides in soil. Compatibility of herbicides with other agrochemicals. Weed management in major field and horticultural crops and in 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.

BSAG-CS704 Farming System & Sustainable Agriculture

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, 92 pastoral, lay farming, shifting cultivation, ranching and 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. Cropping systems, their characteristics and management. Cropping patterns.

Agro-ecosystem and agro-ecological zones of India. Efficient food producing systems. Sustainable agriculture- Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures, land degradation and conservation of natural resources.

BSAG-CS705 Production Technology of Spices, Aromatic, Medicinal and Plantation Crops

Important Spice crops- Ginger, Turmeric, Dill Seed, Pepper, Cardamom, Coriander, Cumin, Fennel, Celery and Fenugreek. Aromatic crops- Mentha, Lemongrass, Citronella, Palmarosa, Vetiver and Geranium. Medicinal plants- Dioscoria, Rauvolfia, Opium, Periwinkle, Guggal, Belladonna, Nuxvomica, Solanum nigrum, Senna, Amla, Isabgol, Coleus, Acorus and Pipli (mug); 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.

BSAG-CS706 Production Technology of Economic Forest Trees

Plantation silviculture: native versus exotics; even-aged versus uneven-aged; monoculture versus mixed culture. Plantation technology and tending operations of economically important tree species. Agroforestry concept and suitable agroforestry systems/models for different regions. Economic and ecological aspects of agroforestry systems. Importance of superior phenotypes, their evaluation and use in plantations. Climate change and forests. Forest regeneration, productivity and rotation. Desertification and rehabilitation of waste lands. Short rotation intensive management of forest plantations. Trees 133 outside forests, energy/industrial plantation and dendro- remediation. Production and marketing of forestry produce. Forest fire and its management. Wood based industries and importance of nontimber forest produce. Framework for forestry extension: participatory rural appraisal and joint forest management.

BSAG-CS707 Soil Survey, Classification and Mapping (Practical)

Application and use of global positioning system for soil survey. Macro-morphological study of soils. Classification of soils developed on different landforms. 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 for preparing thematic maps

---

BSAG-CS708 Soil Physical & Biological Environment (Practical)

Determination of dry and wet stability of aggregates. Measurement of in situ 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 Reflectrometry. 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.

BSAG-CS709 Analytical Techniques in Soils, Plants, Fertilizers and Water (Practical)

Preparation of standard solutions. Collection of soil, water, plant and fertilizer samples. Analysis of soil samples for fertility and quality evaluation for field crops 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.

BSAG-CS710 Weed Management (Practical)

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.

BSAG-CS711 Farming System & Sustainable Agriculture (Practical)

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 lay out 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 situation.

BSAG-CS712 Production Technology of Spices, Aromatic, Medicinal and Plantation Crops (Practical)

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.

BSAG-CS713 Production Technology of Economic Forest Trees (Practical)

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)

28 Hrs.

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-HC701	Nursery Management of Horticultural Crops	2	0	0	40	60	100	2
BSAG-HC702	Commercial Fruit Production	2	0	0	40	60	100	2
BSAG-HC703	Processing and Value Addition of Horticultural Crops	2	0	0	40	60	100	2
BSAG-HC704	Commercial Vegetable Production	2	0	0	40	60	100	2
BSAG-HC705	Vegetable Breeding and Seed Production	2	0	0	40	60	100	2
BSAG-HC706	Forcing Techniques in Vegetable Production	2	0	0	40	60	100	2
BSAG-HC707	Commercial Floriculture and Landscaping	2	0	0	40	60	100	2
BSAG-HC708	Nursery Management of Horticultural Crops (Practical)	0	0	2	20	30	50	1
BSAG-HC709	Commercial Fruit Production (Practical)	0	0	2	20	30	50	1
BSAG-HC710	Processing and Value Addition of Horticultural Crops (Practical)	0	0	2	20	30	50	1
BSAG-HC711	Commercial Vegetable Production (Practical)	0	0	2	20	30	50	1
BSAG-HC712	Vegetable Breeding and Seed Production (Practical)	0	0	2	20	30	50	1
BSAG-HC713	Forcing Techniques in Vegetable Production (Practical)	0	0	2	20	30	50	1
BSAG-HC714	Commercial Floriculture and Landscaping (Practical)	0	0	2	20	30	50	1
	Total	14	0	14	420	630	1050	21

BSAG-HC701 Nursery Management of Horticultural Crops

Principles of plant propagation. Seed dormancy and germination. Selection of rootstock and scion. Stock scion relationship. Factors affecting successful propagation. Physiology of dwarfing rootstock. Different methods of propagation like division, cutting, layering, budding and grafting, and tissue culture. Containers, media and mixtures. Propagation structures. Nursery act, quarantine and certification. Nutrient management and plant protection measures in nursery. Economics of raising fruit plant nursery.

BSAG-HC702 Commercial Fruit Production

Importance and uses, botany, flowering and fruiting, climate and soil, promising varieties, horti-agri techniques, production, plant protection measures and special problems in fruits such as citrus, mango, guava, apple, pear, peach, plum, ber, litchi, grapes, pomegranate, papaya, pineapple, phalsa, banana and sapota.

BSAG-HC703 Processing and Value Addition of Horticultural Crops

Scope of fruit preservation industry in India, present status, constraints and prospects. Importance, principles and practices of fruit processing. Maturity indices, harvesting, transportation and quality 138 parameters of fruits. Pre and post harvest factors affecting processing quality of fruits. Commercial processing technologies for fruits like mango, citrus, guava, grapes, ber, apple, pear, peach, plum, phalsa, litchi, pomegranate and papaya etc. Packing technology for export and value addition.

BSAG-HC704 Commercial Vegetable Production

Role of soil, climatic and agronomic factors in vegetable production. Principles of cultivation including direct sowing, nursery management, transplanting, hardening of seedlings and vegetable forcing. Weeds and their control. Rotation and Intercropping in vegetable crops. Export potentiality, post harvest handling, processing, storage and marketing of vegetables.

BSAG-HC705 Vegetable Breeding and Seed Production

Scope of vegetable breeding and seed production. Origin, floral biology and breeding systems in vegetable crops. Germplasm resources. Principles and methods of breeding self-pollinated, often cross-pollinated and cross- pollinated vegetable crops. Plant introduction, selection, hybridization,

population improvement, mutation and polyploidy. Seed production of conventional varieties. Production of F1 hybrids using male sterility, self-incompatibility, various sex-forms etc. 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.

BSAG-HC706 Forcing Techniques in Vegetable Production

Objectives, importance and scope of protected cultivation. Nursery raising techniques. Environmental factors. Vegetable growing media. Irrigation and fertigation. Sustainable land use systems. Maximising land use efficiency in protected structures. Problems of growing vegetables in protected structures,. Soil sterilization techniques. Hydroponics cultivation. . Pest management in green house/glass house. Crops and varieties suitable for protected cultivation. 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.

BSAG-HC707 Commercial Floriculture and Landscaping

Scope, importance and export potential of floriculture, environment factors influencing plant growth and flower production in cut flowers. Production technology including varieties, propagation, soil, nutrition, disease and pests of important cut flowers. Post harvest handling, grading and packing cut flowers, pot and bedding plants. 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. Principles of art and landscaping. Preparation of landscape plans for homes, farm complexes, small parks and institutions. Development and maintenance of rock, water and terrace gardens. Bonsai and dish gardens, project formulation and evaluation.

BSAG-HC708 Nursery Management of Horticultural Crops (Practical)

Raising of rootstock. Methods to break seed dormancy. Propagation techniques. Training, lifting and packing of nursery plants. Preparation of media and mixtures, and raising nursery in poly bags. Project formulation and valuation of nursery raising.

BSAG-HC709 Commercial Fruit Production (Practical)

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

BSAG-HC710 Processing and Value Addition of Horticultural Crops (Practical)

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

BSAG-HC711 Commercial Vegetable Production (Practical)

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.

BSAG-HC712 Vegetable Breeding and Seed Production (Practical)

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.

BSAG-HC713 Forcing Techniques in Vegetable Production (Practical)

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 glasshouse. Visit to established greenhouses in the region.

BSAG-HC714 Commercial Floriculture and Landscaping (Practical)

Preparation of plans and laying out of gardens. Identification of planting material and commercial varieties of flowers. Seed collection, germination tests and storage. Harvesting and handling of cut flowers. Judging of flowers and pot plants. Visit to local nurseries and florist centers.

3. Plant Breeding, Genetics & Biotechnology

27 Hrs

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-PGB701	Genetics of Crop Plants	2	0	0	40	60	100	2
BSAG-PGB 702	Cytogenetics of Crop Plants	2	0	0	40	60	100	2
BSAG- PGB 703	Theory and Practice of Plant Breeding	3	0	0	60	90	150	3
BSAG- PGB 704	Breeding of Field Crops	3	0	0	60	90	150	3
BSAG- PGB 705	Crop Experimentation	1	0	0	20	30	50	1
BSAG- PGB 706	Plant Tissue Culture and Transformation	2	0	0	40	60	100	2
BSAG- PGB 707	Molecular Biotechnology and Genomics	2	0	0	40	60	100	2
BSAG- PGB708	Genetics of Crop Plants (Practical)	0	0	2	20	30	50	1
BSAG- PGB 709	Cytogenetics of Crop Plants (Practical)	0	0	2	20	30	50	1
BSAG- PGB 710	Theory and Practice of Plant Breeding(Practical)	0	0	2	20	30	50	1
BSAG- PGB 711	Crop Experimentation (Practical)	0	0	2	20	30	50	1
BSAG- PGB 712	Plant Tissue Culture and Transformation (Practical)	0	0	2	20	30	50	1
BSAG- PGB 713	Molecular Biotechnology and Genomics (Practical)	0	0	2	20	30	50	1
	Total	15	0	12	420	630	1050	21

BSAG-PGB 701 Genetics of Crop Plants

Genetic analysis in different systems. Genetic recombination in prokaryotes and eukaryotes. Detection and estimation of linkage from test cross and F2 data. Genetic material - organization, structure and replication. Extra nuclear inheritance. Genetic of quantitative traits. Genetic equilibrium and forces changing gene frequency. Induction, detection and uses of mutations. Gene function. Gene expression. Gene regulation. Environmental influence on gene expression. Gene cloning. Genetic transformation.

BSAG-PGB 702 Cytogenetics of Crop Plants

Structure and function of cell organelles. Chromosomal theory of inheritance. Morphology, ultra structure and differential staining of chromosomes. Unusual chromosomes. Cell cycle. Cytological, genetic and morphological effects of chromosomal aberrations. Classification, induction, characterization and utilization of haploids, euploids and aneuploids. In situ hybridization. Evolution of karyotype. Genome analysis in wheat, cotton, Brassica species.

BSAG-PGB 703 Theory and Practice of Plant Breeding

Role of plant breeding. Centres of origin of crop plants. Plant genetic resources and their utilization. Breeding systems. Breeding methods in self-pollinated, cross-pollinated and vegetatively propagated crops and their genetic basis. Heterosis and its exploitation. Male sterility and self-incompatibility. Mutation and polyploidy. Breeding for quality traits. Breeding for abiotic and biotic stresses. Wide hybridization. Procedures for the release of new varieties. Plant breeding for sustainable agriculture. Plant Variety Protection and Breeders' Rights.

BSAG-PGB 704 Breeding of Field Crops

Application of genetic, cytogenetic and biotechnological techniques in breeding of wheat, triticale, rice, maize, bajra, barley, sorghum, cotton, sugarcane, important pulses, oilseeds and forage crops including their origin and germplasm sources. Problems and present status of crop improvement in India with emphasis on the work done in Punjab. National and International centres of crop improvement.

BSAG-PGB 705 Crop Experimentation

Experiments in Plant Breeding - objectives, analysis and interpretation of results. Statistics in relation to crop experimentation. Principles of experimental designs. Uniformity trials, progeny rows trials, compact family block design, completely randomized block design, randomized block design, incomplete block 145 designs. Simple lattice. Augmented designs. Varietal trials over years and locations. G x E and estimation of genetic components. Analysis of co-variance. Determination of yield through its components.

BSAG-PGB 706 Plant Tissue Culture and Transformation

Concepts of plant tissue culture and transformation. Various aspects of plant tissue culture. GMO's / LMO's/ transgenics. Gene transfer methods. Agrobacterium mediated plant transformation. Particle gun mediated plant transformation. Molecular characterization of transgenic plants using PCR, Southern and Western analysis. Bioassays with transgenic plants. Genetic engineering of crop plants for useful traits. Foods for the future. Biosafety concerns and regulatory mechanisms. Commercialization of transgenic products.

BSAG-PGB 707 Molecular Biotechnology and Genomics

Classification, properties and uses of restriction endonucleases. Characteristics and uses of plasmids in molecular biology. Recombinant DNA technology. Construction and uses of genomic and cDNA libraries. Genome organization of prokaryotes and eukaryotes. Southern, Northern and Western hybridization. RFLPs. Polymerase chain reaction. PCR-based markers like RAPDs, SSRs, ISSRs, STS, Scars. Generation of molecular maps. Applications of biotechnology in crop improvement. DNA sequencing. Gene cloning approaches. Functional genomics, proteomics and bioinformatics.

BSAG-PGB 708 Genetics of Crop Plants (Practical)

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.

BSAG-PGB 709 Cytogenetics of Crop Plants (Practical)

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.

BSAG-PGB 710 Theory and Practice of Plant Breeding (Practical)

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

BSAG-PGB 711 Crop Experimentation (Practical)

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

BSAG-PGB 712 Plant Tissue Culture and Transformation (Practical)

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.

BSAG-PGB 713 Molecular Biotechnology and Genomics (Practical)

Isolation, purification and fractionation of DNA and proteins. Isolation and purification of plasmids. Measurement of protein and nucleic acid concentration using photospectrometer. 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-extension, Economics & Business Management

25 Hrs

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-AEB701	Visual and Graphic Communication	1	0	0	20	30	50	1
BSAG- AEB 702	Communication and Information Technology	2	0	0	40	60	100	2
BSAG- AEB 703	Behavioural Skills for Human Resource Development	2	0	0	40	60	100	2
BSAG- AEB 704	Micro Economic Analysis	3	0	0	60	90	150	3
BSAG- AEB 705	Macro Economic Analysis	3	0	0	60	90	150	3
BSAG- AEB 706	Financial and Project Management	3	0	0	60	90	150	3
BSAG- AEB 707	Retailing and Supply Chain Management	3	0	0	60	90	150	3
BSAG- AEB708	Visual and Graphic Communication (Practical)	0	0	2	20	30	50	1
BSAG- AEB 709	Communication and Information Technology (Practical)	0	0	2	20	30	50	1
BSAG- AEB 710	Micro Economic Analysis (Practical)	0	0	2	20	30	50	1
BSAG- AEB 711	Financial and Project Management (Practical)	0	0	2	20	30	50	1
	Total	17	0	8	420	630	1050	21

BSAG-AEB 701 Visual and Graphic Communication

Definition, characteristics, classification, principles and role of visuals in communication. Contribution of visual perception in learning process. Planning, preparation, presentation and evaluation of visual aids, low cost visuals, photographs and pictures. Computer based digitized visual materials. Use of drawing techniques for visuals. 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 in agriculture.

BSAG-AEB 702 Communication & Information Technology

Introduction to communication. Problems in communication and feedback. Role of information and communication technology in agriculture and rural development. Extension teaching methods and their use. Trends in agriculture information management system. Need and scope of cyber extension. Importance of kiosks, agri- portal, internet café, community and FM radio in villages. Privatization of cyber extension. Public-private partnership. Development of Information Communication Technology (ICT) in changing the agricultural scenario.

BSAG-AEB 703 Behavioural Skills for Human Resource Development

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. Motivational skills for attitudinal and perceptional changes. Problem-solving skills. Innovativeness in human behaviour, response and resistance to change. Concept of self, Johari's window model. Defence mechanism. Group dynamics. Group behaviour and conflict management. Decision-making process. Theories of leadership. Concept of human resource development and human relations. Human interaction, its importance and types. Interpersonal perception and social behaviour.

BSAG-AEB 704 Micro Economic Analysis

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. 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. 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. 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.

BSAG-AEB 705 Macro Economic Analysis

Macro Economics: meaning, definition, importance, limitations, scope and integration of micro and macro analysis. Basic macro economic concepts. National income: meaning, definition, types, measurement and social accounting. Circular flow of money. Simple Keynesian model of income determination, shifts in aggregate demand. Multiplier. Theories of consumption and investment. Income determination model including money and interest. Monetary policy: meaning, instruments, indicators, lags and effectiveness. 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. 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.

BSAG-AEB 706 Financial & Project Management

Importance, need, scope and functions of finance. Concept of time value of money. Capital budgetingconcept and steps in capital budgeting, appraisal criteria- pay back period, average rate of return, net present value, benefit cost ratio and internal rate of return. Working Capital Management- concept, determinants and need for working capital in agribusiness. Introduction, objectives and techniques of inventory management for agribusiness. 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.

BSAG-AEB 707 Retailing and Supply Chain Management

Introduction to retailing- definition, concept and overview. Types of retail institutions related to agri- business. Changing food consumption patterns in India. Store location and site selection. Managing retail operationsprocurement and inventory management. Store design- the exterior, interior, layout and display. Promoting store. Introduction to customer relationship management in retail business. Supply chain managementconcept, definition and importance. Elements of

physical distribution systems, building and operating supply chains in agribusiness. Role of IT in supply chain management.

BSAG-AEB 708 Visual and Graphic Communication (Practical)

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.

BSAG-AEB 709 Communication & Information Technology (Practical)

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.

BSAG-AEB 710 Micro Economic Analysis (Practical)

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.

BSAG-AEB 711 Financial & Project Management (Practical)

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

32 Hrs

Course Code	Course Title	Load Allocation			Marks Distribution		Total	Credits
		L	T	P	Internal	External		
BSAG-PP701	Apiculture	1	0	0	20	30	50	1
BSAG- PP 702	Biocontrol and Integrated Pest Management	2	0	0	40	60	100	2
BSAG- PP 703	Pesticides and Plant Protection Equipment	2	0	0	40	60	100	2
BSAG- PP 704	Biocontrol and Integrated Disease Management	2	0	0	40	60	100	2
BSAG- PP 705	Post Harvest Diseases & their Management	2	0	0	40	60	100	2
BSAG- PP 706	Plant Nematology	1	0	0	20	30	50	1
BSAG- PP 707	Plant Disease Diagnosis (Practical)	0	0	4	40	60	100	2
BSAG- PP708	Apiculture (Practical)	0	0	4	40	60	100	2
BSAG- PP 709	Biocontrol and Integrated Pest Management (Practical)	0	0	4	40	60	100	2
BSAG- PP 710	Pesticides and Plant Protection Equipment (Practical)	0	0	2	20	30	50	1
BSAG- PP 711	Biocontrol and Integrated Disease Management (Practical)	0	0	4	40	60	100	2
BSAG- PP 712	Post Harvest Diseases & their Management (Practical)	0	0	2	20	30	50	1
BSAG- PP 713	Plant Nematology (Practical)	0	0	2	20	30	50	1
	Total	10	0	22	420	630	1050	21

BSAG-PP 701 Apiculture

Indian history of beekeeping. Species and races of honey bees. Morphology and anatomy of honey bee. Colony organization, life cycle and division of labour in Apis mellifera. Seasonal management of honey bee colonies; swarming, drifting and curbing drone population. Management of queenless and laying worker colonies. Colony multiplication. Bee enemies and diseases. Protection from pesticidal hazards. Maximizing honey production. Bee flora. Managed bee pollination of crops. Colony migration. Apicultural diversification. Honey and its quality. Economics of beekeeping.

BSAG-PP 702 Biocontrol and Integrated Pest Management

History and concept of biological control, different groups of biological control agents and biopesticidesmacrobials (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. 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. 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. Decision making systems. Potential of IPM, its implementation and constraints. Successful example in IPM.

BSAG-PP 703 Pesticides and Plant Protection Equipment

Pesticides- classification, properties, entry and mode of action. Formulations and toxicity of pesticides. Factors affecting toxicity of pesticides.Compatibility and synergism. Antidotes. Problems associated with the use of pesticides. Role of repellents, attractants, pheromones, hormones, chemosterilants and antifeedants in pest control. Pest control equipment - history of development, classification, constructional features, principles of working, operation, maintenance and selection. Planning of pest control operations.

BSAG-PP 704 Biocontrol and Integrated Disease Management

History and principles underlying host resistance, chemical, physical, cultural, biological and legislative measures of plant disease management. Scope and factors affecting biological control. Mechanisms of bio-control. Characterization of bioagents and their commercial formulations. Limitations of biocontrol. Commercial production and distribution system. Integrated disease management. Historical 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. 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 phytosanitory measures.

BSAG-PP 705 Post Harvest Diseases and their Management

Importance of post-harvest diseases. Important post-harvest diseases of fruits and vegetables. Factors affecting ripening of fruits and vegetables. Factors favoring development of post-harvest diseases. Effect of 154 handling and storage practices on the development of post-harvest diseases. Storage methods and conditions. Disease management strategies for post-harvest diseases.

BSAG-PP 706 Plant Nematology

History and economic importance of plant parasitic nematodes. General characteristics, identification, their classification and relationship with other organisms. Morphology and biology of important genera, namely Meloidogyne, Heterodera, Globodera, Anguina, Rotylenchulus, Ditylenchus, Tylenchulus, Pratylenchus, Radopholus and virus vectors. Principles and methods of control.

BSAG-PP 707 Plant Disease Diagnosis (Practical)

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 toxaemias. Types of chemicals used for the control of plant diseases and methods of their application. Cultural and biological methods of plant disease control.

BSAG-PP 708 Apiculture (Practical)

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 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).

BSAG-PP 709 Biocontrol and Integrated Pest Management (Practical)

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.

BSAG-PP 710 Pesticides and Plant Protection Equipment (Practical)

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. Calibrations of plant protection equipments. Common troubles in the use of pest-control equipment and their remedies. Estimation of pesticide residue in food commodities.

BSAG-PP 711 Biocontrol and Integrated Disease Management (Practical)

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.

BSAG-PP 712 Post Harvest Diseases and their Management (Practical)

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.

BSAG-PP 713 Plant Nematology (Practical)

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.
