

# **Study Scheme & Syllabus of B. Sc. (Hons) Agriculture Batch 2019 onwards**



**By**

**Board of Studies Agriculture  
Department of Academics  
IK Gujral Punjab Technical University Jalandhar**

## B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards

### Semester – First

Course code	Course Title	Load Allocation		Marks Distribution		Total	Credits
		L	P	Internal	External		
BSAG-101-19	Fundamentals of Horticulture	1	0	40	60	100	1
BSAG-102-19	Fundamentals of Soil Science	2	0	40	60	100	2
BSAG-103-19	Introduction to Forestry	1	0	40	60	100	1
BSAG-104-19	Comprehension & Communication Skills in English	1	0	40	60	100	1
BSAG-105-19	Fundamentals of Agronomy	2	0	40	60	100	2
BSAG-106-19 (A)	Introductory Biology*	2	0	40	60	100	2
BSAG-106-19 (B)	Elementary Mathematics**	2	0	40	60	100	2
BSAG-107-19	Agricultural Heritage	1	0	40	60	100	1
BSAG-108-19	Rural Sociology & Educational Psychology	1	0	40	60	100	1
BSAG-109-19	Human Values & Ethics	1	0	Satisfactory / Un Satisfactory			Non-Credit
BSAG-110-19	Fundamentals of Horticulture (Practical)	0	2	20	30	50	1
BSAG-111-19	Fundamentals of Soil Science (Practical)	0	2	20	30	50	1
BSAG-112-19	Introduction to Forestry (Practical)	0	2	20	30	50	1
BSAG-113-19	Comprehension & Communication Skills in English (Practical)	0	2	20	30	50	1
BSAG-114-19	Fundamentals of Agronomy (Practical)	0	2	20	30	50	1
BSAG-115-19	Introductory Biology (Practical)	0	2	20	30	50	1
BSAG-116-19	NSS /NCC / Physical Education & Yoga Practices	0	2	Satisfactory / Un Satisfactory			Non-Credit
Total		14	14	480	720	1200	19

**\*Remedial course for students who had studied non-medical in 10+2**

**\*\* Remedial course for students who had studied medical in 10+2**

## B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards

### Semester – Second

Course code	Course Title	Load Allocation		Marks Distribution		Total	Credits
		L	P	Internal	External		
BSAG-201-19	Fundamentals of Genetics	2	0	40	60	100	2
BSAG-202-19	Agricultural Microbiology	1	0	40	60	100	1
BSAG-203-19	Soil and Water Conservation Engineering	1	0	40	60	100	1
BSAG-204-19	Fundamentals of Crop Physiology	1	0	40	60	100	1
BSAG-205-19	Fundamentals of Agricultural Economics	2	0	40	60	100	2
BSAG-206-19	Fundamentals of Plant Pathology	3	0	40	60	100	3
BSAG-207-19	Fundamentals of Entomology	3	0	40	60	100	3
BSAG-208-19	Fundamentals of Agricultural Extension Education	2	0	40	60	100	2
BSAG-209-19	Communication Skills and Personality Development	1	0	40	60	100	1
BSAG-210-19	Fundamentals of Genetics (Practical)	0	2	20	30	50	1
BSAG-211-19	Agricultural Microbiology (Practical)	0	2	20	30	50	1
BSAG-212-19	Soil and Water Conservation Engineering (Practical)	0	2	20	30	50	1
BSAG-213-19	Fundamentals of Crop Physiology (Practical)	0	2	20	30	50	1
BSAG-214-19	Fundamentals of Plant Pathology (Practical)	0	2	20	30	50	1
BSAG-215-19	Fundamentals of Entomology (Practical)	0	2	20	30	50	1
BSAG-216-19	Fundamentals of Agricultural Extension Education (Practical)	0	2	20	30	50	1
BSAG-217-19	Communication Skills and Personality Development (Practical)	0	2	20	30	50	1
Total		16	16	420	780	1200	24

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-101-19            Fundamentals of Horticulture**

Horticulture - Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; Seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

### **BSAG-102-19            Fundamentals of Soil Science**

Soil as a medium of growth, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy, classification, soils of India; Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature: source, amount and flow of heat in soil; effect on plant growth, Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids- inorganic and organic; silicate clays: constitution and properties; sources of charge; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-103-19 Introduction to Forestry**

Introduction – definitions of basic terms related to forestry, objectives of silviculture, forest classification, salient features of Indian Forest Policies. Forest regeneration, Natural regeneration -natural regeneration from seed and vegetative parts, coppicing, pollarding, root suckers; Artificial regeneration – objectives, choice between natural and artificial regeneration, essential preliminary considerations. Crown classification. Tending operations – weeding, cleaning, thinning – mechanical, ordinary, crown and advance thinning. Forest mensuration – objectives, diameter measurement, instruments used in diameter measurement; measurement of volume of felled and standing trees, age determination of trees. Agroforestry – definitions, importance, criteria of selection of trees in agroforestry, different agroforestry systems prevalent in the country, shifting cultivation, taungya, alley cropping, wind breaks and shelter belts, home gardens. Cultivation practices of two important fast growing tree species of the region. Rejuvenation of forest trees.

### **BSAG-104-19 Comprehension and Communication Skills in English**

War Minus Shooting- The sporting Spirit. A Dilemma- A layman looks at science Raymond B. Fosdick. You and Your English – Spoken English and broken English G.B. Shaw. Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to help the students in the enrichment of vocabulary. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Written Skills: Paragraph writing, Precise writing, Report writing and Proposal writing. The Style: Importance of professional writing. Preparation of Curriculum Vitae and Job applications. Synopsis Writing. Interviews: kinds, Importance and process.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-105-19                    Fundamentals of Agronomy**

Agronomy and its scope, seeds and sowing, tillage and tith, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water and its measurement. Weeds- importance, classification, crop-weed competition, concepts of weed management; principles and methods, allelopathy. Growth and development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, harvesting and threshing of crops.

### **BSAG-106-19(A)                    Introductory Biology**

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics. Binomial nomenclature and classification Cell and cell division. Morphology of flowering plants. Seed and seed germination. Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae. Role of animals in agriculture.

## B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards

### BSAG-106-19(B)

### Elementary Mathematics

Straight lines: Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points  $(x_1, y_1)$  &  $(x_2, y_2)$ , Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line  $y = mx + c$  to the given circle  $x^2 + y^2 = a^2$ . Differential Calculus: Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of  $x^n$ ,  $e^x$ ,  $\sin x$  &  $\cos x$  from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Integral Calculus: Integration of simple functions, Integration of Product of two functions, Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-107-19            Agricultural Heritage**

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture; Past and present status of agriculture and farmers in society; Journey of Indian agriculture and its development from past to modern era; Plant production and protection through indigenous traditional knowledge; Crop voyage in India and world; Agriculture scope; Importance of agriculture and agricultural resources available in India; National agriculture setup in India; Current scenario of Indian agriculture; Indian agricultural concerns and future prospects.

### **BSAG-108-19            Rural Sociology & Educational Psychology**

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Social Ecology, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development. Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, Learning, Motivation, Theories of Motivation, Intelligence.

### **BSAG-109-19            Human Value and Ethics**

Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction. Decision Making. Motivation. Sensitivity. Success. Selfless Service. Case Study of Ethical Lives. Positive Spirit. Body, Mind and Soul. Attachment and Detachment. Spirituality Quotient. Examination.

**BSAG-110-19            Fundamentals of Horticulture (Practical)**

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

**BSAG-111-19            Fundamentals of Soil Science (Practical)**

Study of soil profile in field, Study of soil sampling tools, collection of representative soil sample, its processing and storage, Study of soil forming rocks and minerals, Determination of soil density, moisture content and porosity, Determination of soil texture by feel and Bouyoucos Methods, Studies of capillary rise phenomenon of water in soil column and water movement in soil, Determination of soil pH and electrical conductivity, Determination of cation exchange capacity of soil, Study of soil map, Determination of soil colour, Demonstration of heat transfer in soil, Estimation of organic matter content of soil.

**BSAG-112-19            Introduction to Forestry (Practical)**

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

**BSAG-113-19            Comprehension and Communication Skills in English (Practical)**

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

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-114-19            Fundamentals of Agronomy (Practical)**

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

### **BSAG-115-19            Introductory Biology (Practical)**

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

### **BSAG-116-19            NSS / NCC / Physical Education and Yoga Practices**

1. Teaching of skills of Football/basketball/kabaddi/badminton/table tennis/yoga – demonstration, practice of the skills, correction, involvement in game situation, teaching of rules of the game (For girls teaching of Tennis)
2. Teaching – Meaning, Scope and importance of Physical Education
3. Teaching – Definition, Type of Tournaments
4. Teaching – Physical Fitness and Health Education
5. Construction and laying out of the track and field (\*The girls will have Tennis and Throw Ball).

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG201-19                      Fundamentals of Genetics (Theory)**

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity.

Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes. Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Probability and Chi-square.

Dominance relationships, Epistatic interactions with example.

Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

**BSAG202-19**

### **Agricultural Microbiology**

#### **Theory**

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination transformation, conjugation and transduction, plasmids, transposon.

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

**Theory**

Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

**BSAG204-19**

**Fundamentals of Crop Physiology**

**Theory**

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C<sub>3</sub>, C<sub>4</sub> and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

**Theory**

*Economics:* Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behaviour. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

*Demand:* meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity.

*Production:* process, creation of utility, factors of production, input output relationship. *Laws of returns:* Law of variable proportions and law of returns to scale. *Cost:* concepts, short run and long run cost curves. *Supply:* Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply. *Market structure:* meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. *Distribution theory:* meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

*National income:* Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement.

*Population:* Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and programmes on population control. *Money:* Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation. *Banking:* Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy.

**Theory**

*Introduction:* Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology.

Pathogenesis. Causes/factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

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

*Bacteria and mollicutes:* general morphological characters. Basic methods of classification and reproduction.

*Viruses:* nature, structure, replication and transmission. Study of phanerogamic plant parasites.

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

Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

**BSAG207-19**

### **Fundamentals of Entomology**

History of Entomology in India. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and molting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, Wing venation, modifications and wing coupling apparatus. Structure of male and female genital organ. Metamorphosis and diapause in insects. Types of larvae and pupae. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors— temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance.

Systematics: Taxonomy –importance, history and development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, Blattidae; Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae; Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papilionidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthredinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae.

**Theory**

**Education:** Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

**Rural Development:** concept, meaning, definition; various rural development programmes launched by Govt. of India. **Community Dev.-**meaning, definition, concept & principles, **Philosophy of C.D.** **Rural Leadership:** concept and definition, types of leaders in rural context; **extension administration:** meaning and concept, principles and functions. **Monitoring and evaluation:** concept and definition, monitoring and evaluation of extension programmes; **transfer of technology:** concept and models, capacity building of extension personnel; **extension teaching methods:** meaning, classification, individual, group and mass contact methods, **ICT Applications in TOT (New and Social Media),** media mix strategies; **communication:** meaning and definition; **Principles and Functions of Communication,** models and barriers to communication. **Agriculture journalism;** **diffusion and adoption of innovation:** concept and meaning, process and stages of adoption, adopter categories.

**Theory**

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures.

Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG210-19 Fundamentals of Genetics (Practical)**

Study of microscope. Study of cell structure. Mitosis and Meiosis cell division. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross, Experiments on epistatic interactions including test cross and back cross, Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test. Determination of linkage and cross-over analysis (through two point test cross and three point test cross data). Study on sex linked inheritance in *Drosophila*. Study of models on DNA and RNA structures.

### **BSAG211-19 Agricultural Microbiology (Practical)**

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

### **BSAG212-19 Soil and Water Conservation Engineering (Practical)**

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion.

### **BSAG213-19 Fundamentals of Crop Physiology (Practical)**

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO<sub>2</sub> assimilation by Infra Red Gas Analyser (IRGA).

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG214-19                      Fundamentals of Plant Pathology (Practical)**

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

### **BSAG215-19                      Fundamentals of Entomology (Practical)**

Methods of collection and preservation of insects including immature stages; External features of Grasshopper/Blister beetle; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Dissection of male and female reproductive systems in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG216-19                    Fundamentals of Agricultural Extension Education (Practical)**

To get acquainted with university extension system. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector; preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level; visit to NGO and learning from their experience in rural development; understanding PRA techniques and their application in village development planning; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

### **BSAG217-19                    Communication Skills and Personality Development (Practical)**

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

**B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**  
**Semester–Third**

Course code	Course Title	Load Allocation		Marks Distribution		Total	Credits
		L	P	Internal	External		
BSAG-301-19	Crop Production Technology – I (Kharif Crops)	1	0	40	60	100	1
BSAG-302-19	Fundamentals of Plant Breeding	2	0	40	60	100	2
BSAG-303-19	Agricultural Finance and Cooperation	2	0	40	60	100	2
BSAG-304-19	Agri- Informatics	1	0	40	60	100	1
BSAG-305-19	Farm Machinery and Power	1	0	40	60	100	1
BSAG-306-19	Production Technology for Vegetables and Spices	1	0	40	60	100	1
BSAG-307-19	Environmental Studies and Disaster Management	3	0	40	60	100	3
BSAG-308-19	Statistical Methods	1	0	40	60	100	1
BSAG-309-19	Livestock and Poultry Management	2	0	40	60	100	2
BSAG-310-19	Crop Production Technology – I (Kharif Crops) (Practical)	0	2	20	30	50	1
BSAG-311-19	Fundamentals of Plant Breeding (Practical)	0	2	20	30	50	1
BSAG-312-19	Agricultural Finance and Cooperation (Practical)	0	2	20	30	50	1
BSAG-313-19	Agri- Informatics (Practical)	0	2	20	30	50	1
BSAG-314-19	Farm Machinery and Power (Practical)	0	2	20	30	50	1
BSAG-315-19	Production Technology for Vegetables and Spices (Practical)	0	2	20	30	50	1
BSAG-316-19	Environmental Studies and Disaster Management (Practical)	0	2	20	30	50	1
BSAG-317-19	Statistical Methods (Practical)	0	2	20	30	50	1
BSAG-318-19	Livestock and Poultry Management (Practical)	0	2	20	30	50	1
Total		14	18	540	810	1350	23

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-301-19 Crop Production Technology – I (Kharif Crops)**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops; Cereals – rice, maize and sorghum; Pulses - pigeonpea, mungbean, urdbean and soybean; Oilseeds- groundnut; Fibre crops- cotton & jute; Forage crops- sorghum, cowpea, cluster bean and napier

#### **Recommended books**

1. Handbook of agriculture – ICAR
2. Package of practices for kharif crops- PAU
3. Text book of field crop production- food grains – ICAR
4. Text book of field crop production – commercial crops - ICAR

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-302-19 Fundamentals of Plant Breeding**

Historical development, concept, nature and role of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self-incompatibility and male sterility- genetic consequences, cultivar options. Domestication, Acclimatization and Introduction; Centres of origin/ diversity, components of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self- pollinated crops - mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. Concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement Schemes Ear to row method, Modified Ear to Row, recurrent selection schemes; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization; Maintenance of breeding records and data collection; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

#### **Recommended books**

1. Plant Breeding Principles and Methods by B. D. Singh – Kalyani publishers
2. Principles and Practices Plant Breeding by J. R. Sharma - McGraw Hill Publishing company Limited
3. Introduction to Plant Breeding by R. C. Choudhary- Oxford and IBH. Publishing Company

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-303-19 Agricultural Finance and Cooperation**

Agricultural Finance- meaning, scope and significance; Credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need and its classifications. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance: institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent developments in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDC, NAFED.

#### **Books recommended**

1. Cooperation in India- .F. Banerjee
2. Agricultural Economics by Joginder Singh – Kalyani publishers
3. All-India Rural Credit Survey Review Committee Report – RBI
4. All India Debt and Investment Survey, various issues, NSSO

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-304-19 Agri- Informatics**

Introduction to Computers, Operating Systems, definition and types, Applications of MS Office for document creation & Editing, Data presentation, Interpretation and Graph creation, Statistical analysis, Mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations. e-Agriculture, concepts and applications, Use of ICT in Agriculture. Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planning using IT tools.

#### **Recommended books**

Extension communication and Management – G.I. Ray

Education and Communication for Development – O.P.Dharma and O.P.Bhatnagar

Extension Education – Ranjit Singh

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-305-19 Farm Machinery and Power**

Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

#### **Recommended books**

1. 'Farm Machinery and Equipment', Tata McGraw Hill Publishing Co.
2. 'Farm Power and Machinery', Kitab Mahal.
3. S.C Jain and C.R. Rai, 'Tractor Engine'.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-306-19            Production Technology for Vegetables and Spices**

Importance of vegetables & spices in human nutrition and national economy, kitchen gardening, Origin, area, climate, soil, improved varieties and cultivation practices such as time of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield, physiological disorders, of important vegetable and spices (Tomato, Brinjal, Chilli, Capsicum, Cucumber, Melons, Gourds, Pumpkin, French bean, Peas; Cole crops such as Cabbage, Cauliflower, Knol-khol; Bulb crops such as Onion, Garlic; Root crops such as Carrot, Radish, Beetroot; Tuber crops such as Potato; Leafy vegetables such as Amaranth, Palak. Perennial vegetables).

#### **Recommended Books**

1. H.C. and W.C. Kelly, 'Vegetables Crops', Tata McGraw Hill.
2. D.V.S. Chauhan, 'Vegetable Production in India', Ram Prasad & Sons, Agra.
3. T.K. Bose, 'Vegetables', Naya Prokash, Calcutta.
4. S.P. Singh, 'Production Technology of Vegetables Crops', Agril. Res. Communication Centre, Karnal.
5. B. Choudhary, 'Vegetables', NBT, New Delhi.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-307-19**

### **Environmental Studies and Disaster Management**

Multidisciplinary nature of environmental studies Definition, scope and importance. Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources-Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. • Role of an individual in conservation of natural resources. • Equitable use of resources for sustainable lifestyles. Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and bio-geographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Dues. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

**Disaster Management:**

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents. Disaster Management- Effect to migrate natural disaster at national and global levels. International strategy for disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, community –based organizations and media. Central, state, district and local administration; Armed forces in disaster response; Disaster response; Police and other organizations.

### **Recommended books**

1. Changing Scenario of Punjab Agriculture-An Ecological Perspective- Joginder Singh, G.S.Dhaliwal & N.S.Randhawa CRRID Nov.1997.

**B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

2. Environmental Hazards and Disasters: Contexts, Perspectives and Management - [Bimal Kanti Paul](#) John Wiley & Sons
3. Disaster Management and Risk Reduction: Role of Environmental Knowledge - Anil K. Gupta, Sreeja S. Nair, Sandhya Chatterji, Narosa Publishing House

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-308-19 Statistical Methods**

Introduction to Statistics and its Applications in Agriculture, Graphical Representation of Data, Measures of Central Tendency & Dispersion, Definition of Probability, Addition and Multiplication Theorem (without proof). Simple Problems Based on Probability. Binomial & Poisson Distributions, Definition of Correlation, Scatter Diagram. Karl Pearson's Coefficient of Correlation. Linear Regression Equations. Introduction to Tests of Significance, One sample & two sample test t for Means, Chi-Square Test of Independence of Attributes in  $2 \times 2$  Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

#### **Recommended books**

1. Statistical methods for agricultural workers- R.S. Chandel
2. Research Methodology – C R Kothari and Gaurav Garg

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-309-19 Livestock and Poultry Management**

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry. Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

#### **Recommended books**

1. A textbook of Animal Husbandry- G.C. Banerjee
2. Dairy Bovine Production – C.K.Thomas and NSR Shastry
3. Livestock Production Management – CK Thomas and NSR Shastry
4. Handbook of Animal Husbandry – ICAR Publication
5. Poultry Production Management- R A Singh

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-310-19 Crop Production Technology – I (Kharif Crops) (Practical)**

Rice nursery preparation and, transplanting, sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton, effect of seed size on germination and seedling vigour of kharif season crops, effect of sowing depth on germination of kharif crops, identification of weeds in kharif season crops, top dressing and foliar feeding of nutrients, study of yield contributing characters and yield calculation of kharif season crops, study of crop varieties and important agronomic experiments at experimental farm, study of forage experiments, morphological description of kharif season crops, visit to research centres of related crops.

### **BSAG-311-19 Fundamentals of Plant Breeding (Practical)**

Plant Breeder's kit, Study of germplasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregation populations. Designs used in plant breeding experiments, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out-crossing. Prediction of performance of double cross hybrids.

### **BSAG-312-19 Agricultural Finance and Cooperation (Practical)**

Determination of most profitable level of capital use. Optimum allocation of limited amount of capital among different enterprises. Analysis of progress and performance of cooperatives using published data. Analysis of progress and performance of commercial banks and RRBs using published data. Visit to a commercial bank, cooperative bank and cooperative society to acquire firsthand knowledge of their management, schemes and procedures. Estimation of credit requirement of farm business – A case study. Preparation and analysis of balance sheet – A case study. Preparation and analysis of income statement – A case study. Appraisal of a loan proposal– A case study. Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Seminar on selected topics.

### **BSAG-313-19 Agri- Informatics (Practical)**

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

### **BSAG-314-19 Farm Machinery and Power (Practical)**

Study of different components of I.C. engine. To study air cleaning and cooling system of engine, Familiarization with clutch, transmission, differential and final drive of a tractor, Familiarization with lubrication and fuel supply system of engine, Familiarization with brake, steering, hydraulic control system of engine, Learning of tractor driving, Familiarization with operation of power tiller, Implements for hill agriculture, Familiarization with different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow . Familiarization with seed-cum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter, Familiarization with different types of sprayers and dusters Familiarization with different intercultivation equipment, Familiarization with harvesting and threshing machinery.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-315-19 Production Technology for Vegetables and Spices (Practical)**

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

### **BSAG-316-19 Environmental Studies and Disaster Management (Practical)**

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

### **BSAG-317-19 Statistical Methods (Practical)**

Graphical Representation of Data. Measures of Central Tendency (Ungrouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Central Tendency (Grouped data) with Calculation of Quartiles, Deciles & Percentiles. Measures of Dispersion (Ungrouped Data).

Measures of Dispersion (Grouped Data). Moments, Measures of Skewness & Kurtosis (Ungrouped Data). Moments, Measures of Skewness & Kurtosis (Grouped Data). Correlation & Regression Analysis. Application of One Sample t-test. Application of Two Sample Fisher's t-test. Chi-Square test of Goodness of Fit. Chi-Square test of Independence of Attributes for  $2 \times 2$  contingency table. Analysis of Variance One Way Classification. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

### **BSAG-318-19 Livestock and Poultry Management (Practical)**

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

**B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**  
**Semester– Fourth**

Course code	Course Title	Load Allocation		Marks Distribution		Total	Credits
		L	P	Internal	External		
BSAG-401-19	Crop Production Technology -II (Rabi Crops)	1	0	40	60	100	1
BSAG-402-19	Production Technology for Ornamental Crops, MAP and Landscaping	1	0	40	60	100	1
BSAG-403-19	Renewable Energy and Green Technology	1	0	40	60	100	1
BSAG-404-19	Problematic Soils and their Management	2	0	40	60	100	2
BSAG-405-19	Production Technology for Fruit and Plantation Crops	1	0	40	60	100	1
BSAG-406-19	Principles of Seed Technology	1	0	40	60	100	1
BSAG-407-19	Farming System & Sustainable Agriculture	1	0	40	60	100	1
BSAG-408-19	Agricultural Marketing Trade & Prices	2	0	40	60	100	2
BSAG-409-19	Introductory Agro-meteorology & Climate Change	1	0	40	60	100	1
BSAG-XXX-19	Elective Course-I*	2	0	40	60	100	2
BSAG-410-19	Crop Production Technology -II (Rabi Crops) (Practical)	0	2	20	30	50	1
BSAG-411-19	Production Technology for Ornamental Crops, MAP and Landscaping (Practical)	0	2	20	30	50	1
BSAG-412-19	Renewable Energy and Green Technology (Practical)	0	2	20	30	50	1
BSAG-413-19	Production Technology for Fruit and Plantation Crops (Practical)	0	2	20	30	50	1
BSAG-414-19	Principles of Seed Technology (Practical)	0	4	20	30	50	2
BSAG-415-19	Agricultural Marketing Trade & Prices (Practical)	0	2	20	30	50	1
BSAG-416-19	Introductory Agro-meteorology & Climate Change (Practical)	0	2	20	30	50	1
BSAG-XXX-19	Elective Course-I (Practical)*	0	2	20	30	50	1
Total		13	18	560	840	1400	22

\*Student has to select one elective group and accordingly elective courses has to be cleared in 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> Semester.

## B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards

### Semester– Fifth

Course code	Course Title	Load Allocation		Marks Distribution		Total	Credits
		L	P	Internal	External		
BSAG-501-19	Principles of Integrated Pest and Disease Management	2	0	40	60	100	2
BSAG-502-19	Manures, Fertilizers and Soil Fertility Management	2	0	40	60	100	2
BSAG-503-19	Pests of Crops, Stored Grains and their Management	2	0	40	60	100	2
BSAG-504-19	Diseases of Field and Horticultural Crops and their Management -I	2	0	40	60	100	2
BSAG-505-19	Crop Improvement-I (Kharif Crops)	1	0	40	60	100	1
BSAG-506-19	Entrepreneurship Development and Business Communication	1	0	40	60	100	1
BSAG-507-19	Geo-informatics, Nano-technology and Precision Farming	1	0	40	60	100	1
BSAG-508-19	Intellectual Property Rights	1	0	40	60	100	1
BSAG-XXX-19	Elective Course-II*	2	0	40	60	100	2
BSAG-509-19	Principles of Integrated Pest and Disease Management (Practical)	0	2	20	30	50	1
BSAG-510-19	Manures, Fertilizers and Soil Fertility Management (Practical)	0	2	20	30	50	1
BSAG-511-19	Pests of Crops, Stored Grains and their Management (Practical)	0	2	20	30	50	1
BSAG-512-19	Diseases of Field and Horticultural Crops and their Management -I (Practical)	0	2	20	30	50	1
BSAG-513-19	Crop Improvement-I (Kharif Crops) (Practical)	0	2	20	30	50	1
BSAG-514-19	Entrepreneurship Development and Business Communication (Practical)	0	2	20	30	50	1
BSAG-515-19	Geo-informatics, Nano-technology and Precision Farming (Practical)	0	2	20	30	50	1
BSAG-516-19	Practical Crop Production - I (Kharif crops) (Practical)	0	4	20	30	50	2
BSAG-XXX-19	Elective Course-II (Practical)*	0	2	20	30	50	1
Total		14	20	540	810	1350	24

**One compulsory educational tour will be conducted in the semester break.**

## B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards

### ELECTIVE COURSE AND THEIR PRACTICAL

	<b>Group A Horticulture</b>	<b>Group B Plant Breeding</b>	<b>Group C Plant Protection</b>	<b>Group D Agricultural Business and management</b>
<b>4th Semester</b>	Protected Cultivation BSAG-417-19	Commercial Plant Breeding BSAG-419-19	Agrochemicals BSAG-421-19	Agri-business Management BSAG-423-19
	Protected Cultivation (Practical) BSAG-418-19	Commercial Plant Breeding (Practical) BSAG-420-19	Agrochemicals (Practical) BSAG-422-19	Agri-business Management (Practical) BSAG-424-19
<b>5th Semester</b>	Landscaping BSAG-517-19	Micro propagation Technologies BSAG-519-19	Biopesticides & Biofertilizers BSAG-521-19	System Simulation and Agro-advisory BSAG-523-19
	Landscaping (Practical) BSAG-518-19	Micro propagation Technologies (Practical) BSAG-520-19	Biopesticides & Biofertilizers (Practical) BSAG-522-19	System Simulation and Agro-advisory (Practical) BSAG-524-19
<b>6th Semester</b>	Hi-tech. Horticulture	Food Safety and Standards	Weed Management	Agricultural Journalism
	Hi-tech. Horticulture (Practical)	Food Safety and Standards (Practical)	Weed Management (Practical)	Agricultural Journalism (Practical)

\*Student has to select one elective group and accordingly elective courses has to be cleared in 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> Semester.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-401-19 Crop Production Technology –II (Rabi Crops)**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops; cereals –wheat and barley, pulses-chickpea, lentil, peas, oilseeds-rape seed, mustard and sunflower; sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

### **BSAG-402-19 Production Technology for Ornamental Crops, MAP and Landscaping**

Importance and scope of ornamental crops, medicinal and aromatic plants (MAP) and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important cut flowers like rose, gerbera, carnation, lily and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, basil, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

### **BSAG-403-19 Renewable Energy and Green Technology**

Classification of energy sources, contribution of these of sources in agricultural sector, Familiarization with biomass utilization for biofuel production and their application, Familiarization with types of biogas plants and gasifiers, biogas, bio-alcohol, bio-diesel and bio-oil production and their utilization as bioenergy resource, introduction of solar energy, collection and their application, Familiarization with solar energy gadgets: solar cooker, solar water heater, application of solar energy: solar drying, solar pond, solar distillation, solar photovoltaic system and their application, introduction of wind energy and their application.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-404-19 Problematic Soils and their Management**

Soil quality and health, Distribution of Waste land and problem soils in India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils.

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

Multipurpose tree species (MPT): bio-remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems.

### **BSAG-405-19 Production Technology for Fruit and Plantation Crops**

Importance and scope of fruit and plantation crop industry in India; Importance of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, litchi, papaya, sapota, apple, pear, peach, walnut, almond and; minor fruits- date, ber, pineapple, pomegranate, jackfruit, strawberry, plantation crops- tea and coffee.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-406-19 Principles of Seed Technology**

Seed and seed technology: introduction, definition and importance. Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage. Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. Private and public sectors and their production and marketing strategies.

### **BSAG-407-19 Farming System & Sustainable Agriculture**

Farming System-scope, importance, and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment, Visit of IFS model in different agro-climatic zones of nearby states University/ institutes and farmers field.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-408-19 Agricultural Marketing Trade & Prices**

Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-409-19 Introductory Agro-meteorology & Climate Change**

Meaning and scope of agricultural meteorology; Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo; Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon- mechanism and importance in Indian agriculture, Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave. Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture.

### **BSAG-410-19 Crop Production Technology –II (Rabi Crops) (Practical)**

Sowing methods of wheat, gram, rapeseed, mustard, berseem and sugarcane, identification of weeds in rabi season crops, study of morphological characteristics of rabi crops, study of yield contributing characters of rabi season crops, yield and juice quality analysis of sugarcane, study of important agronomic experiments of rabi crops at experimental farms. Study of rabi forage experiments, oil extraction of medicinal crops, visit to research stations of related crops.

**BSAG-411-19 Production Technology for Ornamental Crops, MAP and Landscaping  
(Practical)**

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

**BSAG-412-19 Renewable Energy and Green Technology (Practical)**

Familiarization with renewable energy gadgets and solar energy gadgets. To study biogas plants, to study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels.

To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond.

**BSAG-413-19 Production Technology for Fruit and Plantation Crops (Practical)**

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

**BSAG-414-19 Principles of Seed Technology (Practical)**

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

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-415-19 Agricultural Marketing Trade & Prices (Practical)**

Plotting and study of demand and supply curves and calculation of elasticities; Study of relationship between market arrivals and prices of some selected commodities; Computation of marketable and marketed surplus of important commodities; Study of price behaviour over time for some selected commodities; Construction of index numbers; Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class; Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning; Application of principles of comparative advantage of international trade.

### **BSAG-416-19 Introductory Agro-meteorology & Climate Change (Practical)**

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

**BSAG-501-19 Principles of Integrated Pest and Disease Management**

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Surveillance and forecasting of Insect pest and diseases. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide use. Political, social and legal implication of IPM. Case histories of important IPM programmes. Case histories of important IPM programmes.

**BSAG-502-19 Manures, Fertilizers and Soil Fertility Management**

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management.

Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers, soil amendments, Fertilizer Storage, Fertilizer Control Order (FCO), 1982.

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil macro and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

**BSAG-503-19 Pests of Crops, Stored Grains and their Management**

Nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crops, vegetable crops, fruit crops, plantation crops, ornamental crops, spices and condiments. Factors affecting losses of stored grains and role of physical, biological, mechanical and chemical factors in deterioration of grains. Insect pests, mites, rodents, birds and microorganisms associated with stored grains and their management. Storage structure and methods of grain storage and fundamental principles of grains store management.

**BSAG-504-19 Diseases of Field and Horticultural Crops and their Management -I**

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

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

Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic; Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic. Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight; Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off, wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight; Coconut: wilt and bud rot; Tea: blister blight; Coffee: rust.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-505-19 Crop Improvement-I (Kharif Crops)**

Centers of origin, distribution of species, wild relatives of different cash crops of cereals, pulses, oilseeds, fibres, fodders, vegetable and horticultural crops; Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts in breeding of self-pollinated, cross-pollinated and vegetatively propagated crops; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeon pea, etc. Ideotype concept and climate resilient crop varieties for future.

### **BSAG-506-19 Entrepreneurship Development and Business Communication**

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development, Impact of economic reforms on Agribusiness/ Agri-enterprises, Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skills (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill, Supply chain management and Total quality management, Project planning, formulation and report preparation; Financing of enterprise, Opportunities for agri-entrepreneurship and rural enterprise.

**BSAG-507-19 Geo-informatics, Nano-technology and Precision Farming**

Precision agriculture: concepts and techniques; issues and concerns for Indian agriculture. Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop differentiation, Yield monitoring, soil mapping, fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; introduction to crop simulation models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

**BSAG-508-19 Intellectual Property Rights**

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

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

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

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

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **BSAG-509-19 Principles of Integrated Pest and Disease Management (Practical)**

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of Trichoderma, Pseudomonas, Trichogramma, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agroecosystem) dynamics of a selected insect pest and diseases. Development and validation of IPM module (paddy and cotton). Crop monitoring attacked by insect, pest and diseases. Awareness campaign at farmers fields.

### **BSAG-510-19 Manures, Fertilizers and Soil Fertility Management (Practical)**

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

### **BSAG-511-19 Pests of crops, stored grains and their management (Practical)**

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store/godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

**B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**  
**BSAG-512-19 Diseases of Field, Horticultural Crops and their Management -I (Practical)**

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

**BSAG-513-19 Crop Improvement-I (Kharif Crops) (Practical)**

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeon pea, Urd bean, Mung bean, Soybean, Groundnut, Sesame, Castor, Cotton, Cowpea, Brinjal, Okra and Cucurbits. Maintenance breeding of different kharif crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in Kharif crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

**BSAG-514-19 Entrepreneurship Development and Business Communication (Practical)**

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

**BSAG-515-19 Geo-informatics, Nano-technology and Precision Farming (Practical)**

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

**BSAG-516-19 Practical Crop Production – I (Kharif crops) (Practical)**

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management. Management of insect-pests and diseases of crops. Harvesting, threshing, drying, winnowing, storage and marketing of produce. Preparation of balance sheet for computation of cost-benefit ratio (C:B) including cost of cultivation, total cost and gross returns.

## B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards

### ELECTIVE COURSE AND THEIR PRACTICAL

	<b>Group A Horticulture</b>	<b>Group B Plant Breeding</b>	<b>Group C Plant Protection</b>	<b>Group D Agricultural Business and management</b>
<b>4th Semester</b>	Protected Cultivation BSAG-417-19	Commercial Plant Breeding BSAG-419-19	Agrochemicals BSAG-421-19	Agri-business Management BSAG-423-19
	Protected Cultivation (Practical) BSAG-418-19	Commercial Plant Breeding (Practical) BSAG-420-19	Agrochemicals (Practical) BSAG-422-19	Agri-business Management (Practical) BSAG-424-19
<b>5th Semester</b>	Landscaping BSAG-517-19	Micro propagation Technologies BSAG-519-19	Biopesticides & Biofertilizers BSAG-521-19	System Simulation and Agro-advisory BSAG-523-19
	Landscaping (Practical) BSAG-518-19	Micro propagation Technologies (Practical) BSAG-520-19	Biopesticides & Biofertilizers (Practical) BSAG-522-19	System Simulation and Agro-advisory (Practical) BSAG-524-19
<b>6th Semester</b>	Hi-tech. Horticulture	Food Safety and Standards	Weed Management	Agricultural Journalism
	Hi-tech. Horticulture (Practical)	Food Safety and Standards (Practical)	Weed Management (Practical)	Agricultural Journalism (Practical)

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Agri-business Management BSAG-423-19**

Transformation of agriculture into business, various stakeholders and components of agribusiness systems. Importance of agribusiness in the Indian economy and New Agricultural Policy. Distinctive features of Agribusiness Management: Importance and needs of agro-based industries, Classification of industries and types of agro based industries. Institutional arrangement, procedures to set up agro based industries. Constraints in establishing agro-based industries. Agri-value chain: Understanding primary and support activities and their linkages. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture. Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, policies procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance. Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management; project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

### **Agri-business Management (Practical) BSAG-424-19**

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Viable of a project: IRR, NPW and payback criteria.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Agrochemicals** BSAG-421-19

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

Herbicides-Major classes, properties and important herbicides. Fate of herbicides.

Fungicides - Classification – Inorganic fungicides - characteristics, preparation and use of sulfur and copper, Mode of action-Bordeaux mixture and copper oxychloride.

Organic fungicides- Mode of action- Dithiocarbamates-characteristics, preparation and use of Zineb and maneb.

Systemic fungicides- Benomyl, carboxin, oxycarboxin, Metalaxyl, Carbendazim, characteristics and use.

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

Fertilizers and their importance. Nitrogenous fertilizers: Feedstocks and Manufacturing of ammonium sulphate, ammonium nitrate, ammonium chloride, urea. Slow release N-fertilizers. Phosphatic fertilizers: feedstock and manufacturing of single superphosphate. Preparation of bone meal and basic slag. Potassic fertilizers: Natural sources of potash, manufacturing of potassium chloride, potassium sulphate and potassium nitrate.

Mixed and complex fertilizers: Sources and compatibility–preparation of major, secondary and micronutrient mixtures. Complex fertilizers: Manufacturing of ammonium phosphates, nitrophosphates and NPK complexes. Fertilizer control order. Fertilizer logistics and marketing.

Plant bio-pesticides for ecological agriculture, Bio-insect repellent.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Agrochemicals (Practical) BSAG-422-19**

Sampling of fertilizers and pesticides. Pesticides application technology to study about various pesticides appliances. Quick tests for identification of common fertilizers. Identification of anion and cation in fertilizer. Calculation of doses of insecticides to be used. To study and identify various formulations of insecticide available in market. Estimation of nitrogen in Urea. Estimation of water soluble  $P_2O_5$  and citrate soluble  $P_2O_5$  in single super phosphate. Estimation of potassium in Muraite of Potash/ Sulphate of Potash by flame photometer. Determination of copper content in copper oxychloride. Determination of sulphur content in sulphur fungicide. Determination of thiram. Determination of ziram content.

### **Commercial Plant Breeding BSAG-419-19**

Types of crops and modes of plant reproduction. Line development and maintenance breeding in self and cross pollinated crops (A/B/R and two line system) for development of hybrids and seed production. Genetic purity test of commercial hybrids. Advances in hybrid seed production of maize, rice, sorghum, pearl millet, sunflower, cotton pigeon pea, Brassica etc. Quality seed production of vegetable crops (tomato, chilli, brinjal, muskmelon, onion and pumpkin) under open and protected environment. Alternative strategies for the development of the line and cultivars: haploid inducer, tissue culture techniques and biotechnological tools. IPR issues in commercial plant breeding: DUS testing and registration of varieties under PPV & FR Act. Variety testing, release and notification systems in India. Principles and techniques of seed production, types of seeds, quality testing in self and cross pollinated crops.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Commercial Plant Breeding (Practical) BSAG-420-19**

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

### **Protected Cultivation BSAG-417-19**

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate. Cladding material involved in greenhouse/poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops. Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, liliium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc. Cultivation of economically important medicinal and aromatic plants. Off-season production of flowers and vegetables. Insect pest and disease management.

### **Protected Cultivation (Practical) BSAG-518-19**

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

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Landscaping** BSAG-517-19

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes. Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme, Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas, Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

### **Landscaping (Practical)** BSAG-518-19

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

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Biopesticides & Biofertilizers** BSAG-521-19

History and concept of biopesticides. Importance, scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides, and biorationales. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide.

Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Nitrogen fixation -Free living and symbiotic nitrogen fixation. Mechanism of phosphate solubilization and phosphate mobilization, K solubilization. Production technology: Strain selection, sterilization, growth and fermentation, mass production of carrier based and liquid biofertilizers. FCO specifications and quality control of biofertilizers. Application technology for seeds, seedlings, tubers, sets etc. Biofertilizers -Storage, shelf life, quality control and marketing. Factors influencing the efficacy of biofertilizers.

### **Biopesticides & Biofertilizers (Practical)** BSAG-522-19

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

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

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Micro propagation Technologies BSAG-519-19**

Introduction, history, advantages and limitations of micropropagation; Types of cultures (seed, embryo, organ, callus, cell), Stages of micropropagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture), Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures, Production of secondary metabolites, Somaclonal variation, Cryopreservation.

### **Micro propagation Technologies (Practical) BSAG-520-19**

Identification and use of equipments in tissue culture laboratory, nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques for explants, Preparation of stocks and working solution, Preparation of working medium, Culturing of explants: Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos, regeneration of whole plants from different explants, Hardening procedures.

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **System Simulation and Agro-advisory** BSAG-523-19

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams. Evaluation of crop responses to weather elements; Elementary crop growth models; calibration, validation, verification and sensitivity analysis. Potential and achievable crop production- concept and modelling techniques for their estimation. Crop production in moisture and nutrients limited conditions; components of soil water and nutrients balance. Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity; Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

### **System Simulation and Agro-advisory (Practical)** BSAG-524-19

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

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Hi-tech. Horticulture**

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops; Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques, Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding, Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

### **Hi-tech. Horticulture (Practical)**

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

### **Weed Management**

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

### **Weed Management (Practical)**

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

## **B.Sc. (Hons) Agriculture Syllabus Batch 2019 Onwards**

### **Agricultural Journalism**

Agricultural Journalism: The nature and scope of agricultural journalism, characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism. Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines. The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources. Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outting.

### **Agricultural Journalism (Practical)**

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

**Food Safety and Standards**

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM- concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards- Indian Food Regulatory Regime, FSSAI. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

**Food Safety and Standards (Practical)**

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