

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

**CORSE CONTENTS**

**A501101 INTRODUCTORY AGRICULTURE 1**

Art, Science and business of crop production, Basic elements of crop production; Factors affecting crop production; History of Agricultural Development; Ancient India Agriculture in Civilization Era, Chronological Agricultural Technology development in India. Indian Agriculture, balance sheet, liabilities; Assets and Contrasting trends (DATA), Agrl. growth, contrasting food chains, diversity in physiography, Soil groups, marine, livestock and water; Liabilities: Soil factors, weather factors, Economic ecology, dry and irrigation agriculture, Farming Systems approach, value addition, requirements in new technology; Women in Agriculture: multifaceted roles and tasks, work stress factors, Nutritional and rural life standards, role in house hold design making, drudgery reduction for farm women, women friendly agricultural technology; Empowerment of women;

**A501102 PRINCIPLES OF AGRONOMY AND AGRICULTURAL METEOROLOGY 2**

Meaning and scope of Agronomy: National and International Agricultural Research Institutes in India, Agro-climatic zones of India and Rajasthan. Tillage, crops stand establishment, Planting geometry and its effect on growth and yield cropping systems, Harvesting. Agricultural meteorology: Weather and climate, micro-climate, weather elements, Earths' atmosphere, Composition and structure, solar radiation, Nature, properties, depletion, solar constant and energy balance, Atmospheric, temperature, factors affecting, horizontal and vertical distribution, variations and global warming, Air Pressure variations; Wind: factors affecting, cyclones and anticyclones and general circulation, Atmospheric humidity, vapour pressure and saturation, Process of condensation, formation of dew, fog, mist, snow, rain and hail; Formation and classification of clouds, Introduction to monsoon, Basics of weather forecasting.

**A501103 LAB- PRINCIPLES OF AGRONOMY AND AGRICULTURAL METEOROLOGY 1**

Study of tillage implements; Practice of ploughing; Practice of puddling; Study of seeding equipments and introduction of remote sensing. Different methods of sowing; Study of manures, fertilizers and green manure crops / seeds (including calculations); Study of intercultivation implements and practice; Practice of methods of fertilizer applications; Participation in ongoing field operations; Site selection for Agro met observatory; Measurement of temperature; Measurement of rainfall; Measurement of evaporation (atmospheric/soil); Measurement of atmospheric pressure; Measurement of sunshine duration and solar radiation; Measurement of wind direction and speed and relative humidity; Study of weather forecasting and synoptic charts.

**A501104 PRINCIPLES OF GENETICS 2**

Mendel's laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits, Qualitative traits and differences between them; Multiple factor hypothesis; Cytoplasmic inheritance, it's characteristic features and difference between chromosomal and cytoplasmic inheritance; Mutation and it's characteristic features; Methods of inducing mutations and C / B technique. Gene expression and differential gene activation; Lac operon and Fine structure of Gene; Ultra structure of cell and cell organelles and their functions; Study of chromosome structure, morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis, their significance and differences between them; DNA and it's

**GURU KASHI UNIVERSITY**  
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**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

structure, function, types, modes of replication and repair. RNA and its structure, function and types; Transcription, Translation, Genetic code and outline of protein synthesis; Crossing over and factors affecting it; Mechanism of crossing over and Cytological proof of crossing over; Linkage, Types of linkage and estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like Cotton, Wheat, Tobacco, Triticale and Brassicas; Structural chromosomal aberrations.

**A501105 LAB - PRINCIPLES OF GENETICS**

**1**

Microscopy (Light microscopes and electron microscopes; Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of meiosis; Preparation of micro slides and identification of various stages of meiosis; Monohybrid ratio and its modifications; Dihybrid ratio and its modifications; Trihybrid ratio; Chi-square analysis and Interaction of factors; Epistatic factors, Supplementary factors and Duplicate factors; Complementary factors, Additive factors and Inhibitory factors; Linkage – Two point test cross; Linkage – Three point test cross; Induction of polyploidy using colchicines; Induction of chromosomal aberrations using chemicals.

**A501106 FUNDAMENTALS OF SOIL SCIENCE**

**2**

Soil: Pedological and edaphological concepts, Composition of Earth crust; Rocks and minerals Weathering, Soil formation factors and processes Components of soils; Soil profile, Soil physical properties, Soil texture, Textural classes, Particle size analysis, Soil structure Classification, Soil aggregates, significance, Soil consistency, Soil crusting, Bulk density and particle density of soils & porosity, their significance and manipulation, Soil compaction, Soil Colour, Elementary knowledge of soil classification and soils of India; Soil water, Retention and potentials, Soil moisture constants, Movement of soil water, Infiltration, percolation, permeability, Drainage, Methods of determination of soil moisture Thermal properties of soils, Soil temperature, Soil air, Gaseous exchange, Influence of soil temperature and air on plant growth; Soil organic matter, Composition, Decomposability, Humus, Fractionation of organic matter, Carbon cycle, C: N ratio. Soil biology, Biomass, Soil organisms and their beneficial and harmful roles.

**A501107 LAB - FUNDAMENTALS OF SOIL SCIENCE**

**1**

Determination of bulk density and particle density, Aggregate analysis, Soil strength, Soil moisture determination, Soil moisture constants – Field capacity, Infiltration rate, water holding capacity. soil texture and mechanical analysis, Soil temperature. Analytical chemistry – Basic concepts, techniques and calculations. Collection and processing of soil sample for analysis. Organic carbon, pH, EC. Study of a soil profile. Identification of rocks and minerals.

**A501108 FUNDAMENTALS OF SOIL, WATER AND CONSERVATION ENGINEERING**

**2**

Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields. Levelling – levelling equipment, terminology, methods of calculation of reduced levels, types of levelling, contouring. Irrigation, classification of projects, flow irrigation and lift irrigation. Water source, Water lifting devices – pumps (shallow and deep well), capacity, power calculations. Irrigation water measurement – weirs, flumes and orifices and

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

methods of water measurement and instruments. Water conveyance systems, open channel and underground pipeline. Irrigation methods – drip and sprinkle irrigation systems. Soil and water conservation – soil erosion, types and engineering control measures.

**A501109 LAB - FUNDAMENTALS OF SOIL, WATER AND CONSERVATION ENGINEERING 1**

Acquaintance with chain survey equipment; Ranging and measurement of offsets; Chain triangulation; Cross staff survey; Plotting of chain triangulation; Plotting of cross staff survey; Levelling equipment – dumpy level, levelling staff, temporary adjustments and staff reading; Differential leveling; Profile leveling; Contour survey – grid method; Plotting of contours; Study of centrifugal pumping system and irrigation water measuring devices; Study of different components of sprinkler irrigation systems; Study of different components of drip and sprinkler irrigation systems; Uniformity of water application in drip and sprinkler systems; Study of soil and water conservation measures.

**A501110 PLANT PATHOGENS AND PRINCIPLES OF PLANT PATHOLOGY 2**

Introduction, Important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Prokaryotes: classification of prokaryotes according to Bergey's Manual of Systematic Bacteriology. General Characters of fungi, Definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction in fungi (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions and sub-divisions. Introduction: Definition and objectives of Plant Pathology. History of Plant Pathology. Terms and concepts in Plant Pathology. Survival and Dispersal of Plant Pathogens. Phenomenon of infection. Pathogenesis – Role of enzymes, toxins, growth regulators and polysaccharides. Defense mechanism in plants. Plant disease epidemiology. General principles of plant diseases management – Importance, general Principles – Avoidance, exclusion, protection – Plant Quarantine and Inspection – Quarantine Rules and Regulations. Cultural methods – Rougeing, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage. Role and mechanisms of biological control and PGPR. Physical Methods – Heat and Chemical methods – Methods of application of fungicides. Integrated plant disease management (IDM) – Concept, advantages and importance.

**A501111 LAB -PLANT PATHOGENS AND PRINCIPLES OF PLANT PATHOLOGY 1**

Acquaintance to plant pathology laboratory and equipments; Preparation of culture media for fungi and bacteria; Isolation techniques, preservation of disease samples; Study of Pythium, Phytophthora and Albugo; Study of Peronospora, Plasmopara and Bremia; Study of genera Mucor and Rhizopus. Study of Oidium, Erysiphe, Phyllactinia, Uncinula and Podosphaera; Study of Puccinia (different stages), Uromyces, Hemilia; Study of Ustilago; Study of Agaricus, Pleurotus and Ganoderma; Study of Septoria, Colletotrichum, and Pyricularia; Study of Aspergillus, Penicillium, Trichoderma, and Fusarium; Study of Helminthosporium, Drechslera, Alternaria, Cercospora, Rhizoctonia and Sclerotium; Demonstration of Koch's postulates; Study of different groups of fungicides and antibiotics; Preparation of fungicides – Bordeaux mixture, Bordeaux paste, Methods of application

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

of fungicides – seed, soil and foliar; Bio-assay of fungicides – poisoned food technique, inhibition zone technique and slide germination technique; Bio-control of plant pathogens – dual culture technique, seed treatment. Visit to quarantine station and remote sensing laboratory.

**A501112 FUNDAMENTALS OF COMPUTER APPLICATION**

**1**

Introduction to Computers, Anatomy of Computers, Input and Output Devices. Units of Memory, Hardware, Software and Classification of Computers. Personal Computers, Types of Processors, booting of computer, warm and cold booting. Computer Viruses, Worms and Vaccines. Disk Operating System (DOS): Some fundamental DOS Commands, FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files. Applications – MSWORD: Word, processing and units of document, features of word-processing packages. Creating, Editing, Formatting and saving a document in MSWORD; MSEXCEL: Electronic Spreadsheets, concept, packages. Creating, Editing and saving a spreadsheet with MSEXCEL.

**A501113 LAB - FUNDAMENTALS OF COMPUTER APPLICATION**

**1**

Study of Computer Components; Booting of Computer and its Shut Down; Practice of some fundamental DOS Commands, TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, PATH; MSWORD: Creating a Document, Saving and Editing; MSWORD, Use of options from Tool Bars, Format, Insert and Tools (Spelling & Grammar) Alignment of text; MSWORD, Creating a Table, Merging of Cells, Column and Row width; MSEXCEL: Creating a Spreadsheet, Alignment of rows, columns and cells using Format tool bar; MSEXCEL: Entering Expressions through the formula tool bar and use of inbuilt functions, SUM, AVERAGE, STDEV; MSEXCEL: Data Analysis using inbuilt Tool Packs, Correlation & Regression; MSEXCEL: Creating Graphs and Saving with & without data;

**A501114 COMPREHENSION AND COMMUNICATION SKILLS IN ENGLISH**

**2**

Comprehension: Text for comprehension, Let's Go Home & Other Stories, Edited by Meenakshi Mukerjee. Orient Longman, New Delhi. And

1. Essay (not exceeding 400 words)
2. Precis
3. Translation from Hindi into English
4. Allied Grammar: Use of idioms, correction of incorrect sentences, etc

**A501115 BOTANY I**

**3**

Classification of plant kingdom with salient features of each group. Cell-structure and its types. Cell division, types of cell division. Meristematic and permanent tissues and their types. Parts of angiosperms plant. External morphology of root. Tap root and adventitious root system. modified tap and adventitious roots. Morphology of stem. modifications and functions of stem. Structure of leaf. Venation. phyllotaxy. Modifications and functions of leaf. Types of inflorescence. types of fruits. Types of ovules. Vegetative reproduction-natural and artificial. pollination and fertilization. Structure of monocot and dicot seed. Seed germination. Factors affecting germination and seed

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

dormancy. types of dormancy and factors affecting it. Basic knowledge of crop growth and development. phytohormones: brief account and their use in Agriculture.

**A501116 LAB- BOTANY I**

**1**

Study of different plant parts. Description of at least two plant species from each group of plants. Preparation of slides of cell and its inclusions. Study of different types of roots. their modifications. Stem types and their modifications. Parts of leaf. Leaf types. Venation. phyllotaxy. modification of leaf. Flower structure. Insertion of floral whorls on thalamus. Floral diagrams. Racemose. Cymose and special types of inflorescence. Fruit types. structure and germination of monocot and dicot seeds

**A501117 MATHEMATICS-I**

**3**

Complex numbers Geometric series. Logarithms. Binomial theorem for positive index. Trigonometric identities and allied angles, graphs of trigonometric functions, addition and subtraction formulae, sum and product formulae, multiple and sub-multiple angles.

**A501118 LAB -MATHEMATICS-I**

**1**

Tutorials on: complex numbers, geometric series, logarithms, binomial theorem and trigonometric problems

**NON-CREDIT COURSE**

**A501119/A501218/A501316/A501417Lab-NSS/NCC / PHYSICAL EDUCATION 4\*(NC)**

\*One credit for each semester

NSS: Orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, non-formal education of rural youth, eradication of social evils, awareness programmes, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition. NCC: Introduction to NCC, defence services, system of NCC training, foot drill, sizing, forming up in three ranks, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, weapon training – rifle bayonet, light machine gun, sten machine carbine. Introduction and characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging distance, fire discipline and fire control orders, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self defence, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defence, leadership and NCC song. Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules regulations of important games, skill development in any one of the games, football, hockey, cricket, volleyball, badminton, throw ball, tennis. Participation in one of the indoor games, badminton, chess and table tennis. Rules and regulations of athletic events, participation in any one of the athletic events, long jump, high jump, triple jump, javelin throw, discuss throw, shot put, short and long distance running, Safety

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

education, movement education, effective way of doing day-to-day activities. First-aid training, coaching for major games and indoor games. Asians and indigenous ways for physical fitness and curative exercises. Exercises and games for leisure time, use and experience.

**A501201 WATER MANAGEMENT INCLUDING MICRO IRRIGATION**

**1**

Irrigation: definition and objectives, water resources and irrigation development in India and Rajasthan; Soil plant water relationships; Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, scheduling of irrigation; Methods of irrigation: surface, sprinkler and drip irrigation; Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sugarcane, mango, banana and tomato); Agricultural drainage.

**A501202 LAB- WATER MANAGEMENT INCLUDING MICRO IRRIGATION**

**1**

Determination of bulk density by field method; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water through flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Determination of EC, pH, carbonates, bicarbonates, Ca<sup>++</sup> and Mg<sup>++</sup> in irrigation water (quality parameters)

**A501203 PRINCIPLES OF SEED TECHNOLOGY**

**2**

Introduction to Seed Production, Importance of Seed Production, Seed policy, Seed demand forecasting and planning for certified, foundation and breeder seed production, Deterioration of crop varieties, Factors affecting deterioration and their control; Maintenance of genetic purity during seed production, Seed quality; Definition, Characters of good quality seed, Different classes of seed, Production of nucleus & breeder's seed, Maintenance and multiplication of pre-release and newly released varieties in self and cross-pollinated crops; Seed Production, Foundation and certified seed production in maize (varieties, hybrids, synthetics and composites); Foundation and certified seed production of rice (varieties & hybrids); Foundation and certified seed production of sorghum and bajra (varieties, hybrids, synthetics and composites); Foundation and certified seed production of cotton and sunflower (varieties and hybrids); Foundation and certified seed (varieties and hybrids) production of castor, tomato, brinjal, chillies, bhendi, onion, bottle gourd and ridge gourd; Seed certification, phases of certification, procedure for seed certification, field inspection and field counts etc.; Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Duties and powers of seed inspectors, offences and penalties; Seed control order: Seed Control Order 1983, Seed Act 2000 and other issues related to seed quality regulation. Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights, Varietal Identification through Grow-Out Test and Electrophoresis; Seed Drying: Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, Heated air drying, building requirements,

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

types of air distribution systems for seed drying, selection of crop dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying, Planning and layout of seed processing plant; Establishment of seed processing plant. Seed processing: air screen machine and its working principle, different upgrading equipments and their use, Establishing a seed testing laboratory. Seed testing procedures for quality assessment, Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment (Slurry and Mist-O-matic treater), Seed packing and seed storage, stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage, General principles of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control, Seed marketing, marketing structure, marketing organization, sales generation activities, promotional media, pricing policy; Factors affecting seed marketing.

**A501204 LAB- PRINCIPLES OF SEED TECHNOLOGY****1**

Seed sampling principles and procedures; Physical Purity analysis of Field and Horticultural crops; Germination analysis of Field and Horticultural crops; Moisture tests of Field and Horticultural crops; Viability test of Field and Horticultural crops; Seed health test of Field and Horticultural crops; Vigour tests of Field and Horticultural crops; Seed dormancy and breaking methods; Grow out tests and electrophoresis for varietal identification; Visit to Seed production plots of Maize, Sunflower, Bajra, Rice, Sorghum, Cotton, Chillies and Vegetables. (Add or delete crops of the region); Visit to Seed processing plants; Visit to Seed testing laboratories; Visit to Grow out testing farms; Visit to Hybrid Seed Production farms; Varietal identification in seed production plots; Planting ratios, isolation distance, roguing etc

**A501205 SOIL CHEMISTRY, SOIL FERTILITY AND NUTRIENT MANAGEMENT****2**

Soil as a source of plant nutrients. Soil colloids, Properties, nature, types and significance; Layer silicate clays, their genesis and sources of charges, Adsorption of ions, Ion exchange, CEC & AEC Factors influencing ion exchange and its significance. Essential and beneficial elements, criteria of essentiality, forms of nutrients in soil and transformations, mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities. Problem soils – acid, salt affected and calcareous soils, characteristics, nutrient availabilities. Reclamation – mechanical, chemical and biological methods. Fertilizer and insecticides and their effect on soil water and air. Irrigations water – Quality of irrigation water and its appraisal. Indian standards for water quality. Use of saline water for agriculture. Soil fertility – Different approaches for soil fertility evaluation. Soil test based fertilizer recommendations to crops. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Source, method and scheduling of nutrients for different soils and crops grown under rainfed and irrigated conditions.

**A501206 LAB - SOIL CHEMISTRY, SOIL FERTILITY AND NUTRIENT MANAGEMENT****1**

Principles of analytical instruments and their calibration and applications, Colorimetry and flame photometry. Estimation of available N, P, K, S, and Zn in soils, pH, EC, carbonates, bicarbonates, Calcium and magnesium in soil and water. Lime requirement and gypsum requirement of problem soils. Estimation of N, P and K in plants.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**A501207 FUNDAMENTALS OF NEMATOLOGY**

1

Introduction: History of phytonematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes upto family level with emphasis on groups containing economically important genera. Classification of nematodes by habitat. Identification of economically important plant nematodes upto generic level with the help of keys and description. Symptoms caused by nematodes with examples. Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Different methods of nematode management. Cultural methods (crop rotation, fallowing, soil amendments, other land management techniques), physical methods (soil solarisation, hot water treatment) Biological methods, Chemical methods (fumigants, non fumigants). Resistant varieties. IDM.

**A501208 LAB - FUNDAMENTALS OF NEMATOLOGY**

1

Methods of survey – sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following combined Cobb’ s decanting – sieving and Baermann funnel technique, counting and estimation of plant parasitic nematodes; Preparation of temporary and permanent mounts; Method of preparation of perineal patterns for identification of species of Meloidogyne; Study and identification of most important plant parasitic nematodes with special reference to their characteristics and symptomatology – Meloidogyne, Pratylenchus; Heterodera, Ditylenchus, Globodera, Tylenchulus, Xiphinema, Radopholus, Rotylenchulus, and Helicotylenchus. Experimental techniques used in pathogenicity studies with root knot nematode.

**A501209 AGRICULTURAL MICROBIOLOGY**

2

History of Microbiology: Spontaneous generation theory, Role of microbes in fermentation, Germ theory of disease, Protection against infections, Applied areas of Microbiology Metabolism in bacteria: ATP generation, chemoautotrophy, photo autotrophy, respiration, fermentation. Bacteriophages: structure and properties of Bacterial viruses – Lytic and Lysogenic cycles: viroids, prions. Bacterial genetics; Gene expression; Genetic recombination: transformation, conjugation and transduction, genetic engineering, Plasmids, episomes, genetically modified Organisms. Soil Microbiology: Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur, Biological nitrogen fixation. Microflora of Rhizosphere and Phyllosphere Microflora, microbes in composting. Microbiology of Water. Microbiology of food: microbial spoilage and principles of food preservation. Beneficial microorganisms in Agriculture: Biofertilizer (Bacterial Cyanobacterial and Fungal), microbial insecticides, Microbial agents for control of Plant diseases, Biodegradation, Biogas production, Biodegradable plastics, Plant – Microbe interactions.

**A501210 LAB - AGRICULTURAL MICROBIOLOGY**

1

General instructions, Familiarization with instruments, materials, glassware etc. in a microbiology laboratory : Practice of Aseptic methods: I -Evaluation of aseptic technique with Nutrient broth tubes. II-Evaluation of aseptic technique with a Nutrient agar plate. Methods of Sterilization and Preparation of media I-Preparation of nutrient broth, nutrient agar plates, nutrient agar slant and nutrient agar stablbing; II-Sterilization of glassware by Dry heating; III -Sterilization of nutrient broth by Filtration. Plating methods for Isolation and Purification of bacteria I -Isolation of bacteria by Streak plate method. II -Isolation of aerobic spore forming bacteria by Enrichment using Streak plate method. III -Checking of purity of a bacterial culture by Streak plating method. Identification of



**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

bacteria by staining methods and Biochemical tests: I– Morphological examination of bacteria by Simple and Differential staining. II – Different biochemical tests for identification of bacterial culture; Enumeration of bacteria: I -Enumeration of bacteria by Stain slide method. II-Enumeration of bacteria by Most probable number method. III -Enumeration of bacteria by Pour plate method and Spread plate method.

**A501211 PRINCIPLES OF AGRICULTURAL ECONOMICS**

**2**

Economics: Meaning, Definition, Subject matter, Divisions of Economics, Importance of Economics; Agricultural Economics: Meaning, Definition; Basic Concepts: Goods, Service, Utility, Value, Price, Wealth, Welfare. Wants: Meaning, Characteristics, Classifications of Wants, Importance. Theory of consumption: Law of Diminishing Marginal utility, Meaning, Definition, Assumption, Limitations, Importance. Consumer's surplus: Meaning, Definition, Importance. Demand: Meaning, Definition, Kinds of Demand, Demand schedule, Demand Curve, Law of Demand, Extension and Contraction Vs Increase and Decrease in Demand. Elasticity of Demand: Types of Elasticity of Demand, Degrees of price elasticity of Demand, Methods of Measuring Elasticity, Factors influencing elasticity of Demand, Importance of Elasticity of Demand. Welfare Economics: Meaning, Pareto's optimality. National Income: Concepts, Measurement. Public Finance: Meaning, Principles. Public Resource: Meaning, Services Tax, Meaning, And Classification of Taxes: Cannons of Taxation, Public expenditure: Meaning, Principles. Inflation: Meaning, Definition, Kinds of inflation.

**A501212 DIMENSIONS OF AGRICULTURAL EXTENSION**

**2**

Education – Meaning, Definition, Types – Formal, Informal and Non-formal education and their Characteristics. Extension Education and Agricultural Extension – Meaning, Definition, Concepts, Objectives and Principles. Rural development – Meaning, Definition, Concepts, Objectives, Importance and Problems in rural development. Developmental programmes of pre-independence era – Sriniketan, Marthandam, Gurgaon experiment and Gandhian constructive proprogramme. Development programmes of Post independence era, Firka Development, Etawah – Pilot project and Nilokheri Experiment. Community Development Programme – Meaning, Definition, Concepts, Philosophy, Principles, Objectives, Differences between Community Development and Extension Education, National Extension service. Panchayat Raj system – Meaning of Democratic – Decentralization and Panchayat Raj, Three tiers of Panchayat Raj system, Powers, Functions and Organizational setup. Agricultural Development Programmes with reference to year of start, objectives & salient features – Intensive Agricultural District Programme (IADP), High Yielding Varieties Programme (HYVP), Institution Village Linkage Programme (IVLP), Watershed Development Programme (WDP), National Agricultural Technology Project (NATP), ATMA, ATIC. Social Justice and Poverty alleviation programmes – Integrated Tribal Development Agency (ITDA), Integrated Rural Development Programme (IRDP), Swarna Jayanthi Gram Swarojgar Yojana (SGSY), Prime Minsiter Employment Yojana (CMEY). New trends in extension, privatization. Women Development programmes – Development of Women and Children in Rural Areas (DWCRA), Rashtriya Mahila Kosh (RMK), Integrated Child Development Scheme (ICDS) and Mahila Samriddi Yojana (MSY). Reorganized extension system (T&V System) – Salient features, Fortnight Meetings, Monthly workshops, Linkages, Merits and Demerits, Emergence of Broad Based Extension (BBE).

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**A501213 LAB -INFORMATION TECHNOLOGY**

1

Practicing WINDOWS Operating System, Use of Mouse, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars; WINDOWS Explorer, Creating Folders, COPY and PASTE functions; MSACCESS: Creating Database, Structuring with different types of fields; MS Power Point: Preparation of slides on Power Point; Transforming the data of WORD, EXCEL and ACCESS to other formats.

**A501214 ZOOLOGY I**

3

Introduction to Zoology. Structure of animal cell and its organelles. Differences between animal and plant cell. Cell division mitosis. Elementary knowledge of chemical constituents of living bodies- proteins, carbohydrates, lipids, nucleic acids and enzymes. Types of animal tissues. Salient features of classification of animals (non-chordates upto phylum level and chordates upto class level with examples). Binomial nomenclature. Study of external characters, habits and habitat of Amoeba, Entamoeba, a sponge, Hydra, liverfluke, Ascaris, tape worm, earthworm, cockroach, grass-hopper, snail, starfish, fish, frog, snake, lizard, pigeon and rabbit. Study of different systems of earthworm and cockroach. Zoological parks and museums. Origin of life and evolution.

**A501215 Lab-ZOOLOGY I**

Microscopic study of animal cell, cell division and animal tissues. General survey of animal kingdom. Study of the characteristic features of different animal types. Dissection of earthworm and cockroach. Visit to a Zoological museum/park.

**A501216 MATHEMATICS-II**

3

Definition of function. Limit. Continuity. Differentiation, successive differentiation, geometrical interpretation of derivative. Indefinite integration, integration by substitution, partial fractions and their use in integration. Integration by parts.

**A501217 LAB-MATHEMATICS-II**

1

Tutorials on: limit, continuity, differentiation, successive differentiation, indefinite integration, integration by substitution, partial fractions and their application in integration. Integration by parts.

**A501301 FIELD CROPS-I (KHARIF)**

2

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of *kharif crops*, Cereals – rice, maize, sorghum, pearl millet and minor millets; Pulses : pigeonpea, mungbean and urdbean; Oilseeds: groundnut, sesame and soybean; Fibre crops: cotton, jute and sunhemp; and Forage crops: sorghum, maize, cowpea, cluster bean and napier.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**A501302 LAB-FIELD CROPS-I (KHARIF) 1**

Study of tillage implements. Practice of ploughing and puddling. Seed bed preparation, sowing, fertilizer application, nursery raising and transplanting of *Kharif* crops. Calculations of seed rate. Effect of seed size and sowing depth on germination. Identification of weeds of *Kharif* crops. Fertilizer experiments on rice, maize, sorghum and millets. Study of yield components. Study of crop varieties and important agronomic experiments. Study of forage crops.

**A501303 PRINCIPLES OF PLANT BREEDING 2**

Classification of plants, Botanical description, floral biology, Emasculation and Pollination techniques in cereals, millets, pulses, oil seeds, fibers, plantation crops etc. Aims and objectives of Plant Breeding; Modes of reproduction, Sexual, Asexual, Apomixis and their classification; Significance in plant breeding; Modes of pollination, genetic consequences, differences between self and cross pollinated crops; Methods of breeding – introduction and acclimatization. Selection, Mass selection Johannson’ s pure line theory, genetic basis, pure line selection; Hybridization, Aims and objectives, types of hybridization; Methods of handling of segregating generations, pedigree method, bulk method, back cross method and various modified methods; Incompatibility and male sterility and their utilization in crop improvement; Heterosis, inbreeding depression, various theories of Heterosis, exploitation of hybrid vigour development of inbred lines, single cross and double cross hybrids; Population improvement programmes, recurrent selection, synthetics and composites; Methods of breeding for vegetative propagated crops; Clonal selection; Mutation breeding; Ploidy breeding;

**A501304 LAB - PRINCIPLES OF PLANT BREEDING 1**

Botanical description and floral biology; Study of megasporogenesis and microsporogenesis; Fertilization and life cycle of an angiospermic plant; Plant Breeder’ s kit; Hybridization techniques and precautions to be taken; Floral morphology, selfing, emasculation and crossing techniques; Study of male sterility and incomparability in field plots; Rice and Sorghum; Maize and Wheat; Bajra and ragi; Sugarcane and coconut; Groundnut, Castor, Safflower and Sesamum; Red gram, Bengal gram and Green gram; Soybean and black gram; Chillies, Brinjal and Tomato; Bhendi, Onion, Bottle gourd and Ridge gourd; Cotton and Mesta; Jute and Sun hemp Wide hybridization, significance in crop improvement.

**A501305 INSECT MORPHOLOGY AND SYSTEMATIC 2**

History of Entomology in India. Factors for insects abundance. Classification of phylum Arthropoda upto classes. Relationship of class Insecta with other classes of Arthropoda. Morphology: Structure and functions of insect cuticle and moulting. Body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts and legs. Wing venation, modifications and wing coupling apparatus. Structure male and female genitalia. Sensory organs. 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. Systematics: Taxonomy –importance, history and

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

development and binomial nomenclature. Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders. Orthoptera, Acrididae. Dictyoptera, Mantidae, Odonata, Isoptera, Termitidae, Thysanoptera, Thripidae, Hemiptera, Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Neuroptera, Chrysopidae Lepidoptera, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Coleoptera, Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Hymenoptera, Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Diptera, Cecidomyiidae, Trypetidae, Tachinidae, Agromyziidae.

**A501306 LAB - INSECT MORPHOLOGY AND SYSTEMATIC**

**1**

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's

**A501307 FARM POWER AND MACHINERY**

**2**

Farm power in India: sources, I.C engines, working principles, two stroke and four stroke engines, I.C. engine terminology, different systems of I.C. engine. Tractors, Types, Selection of tractor and cost of tractor power. Tillage implements: Primary and Secondary tillage implements, Implements for intercultural operations, seed drills, paddy transplanters, plant protection equipment and harvesting equipment; Equipment for land development and soil conservation.

**A501308 LAB - FARM POWER AND MACHINERY**

**1**

Study of different components of I.C. Engine; Study of working of four stroke engine; Study of working of two stroke engine; Study of M.B. plough, measurement of plough size, different parts, horizontal and vertical suction, determination of line of pull etc.; Study of disc plough; Study of seed-cum-fertilizer drills-furrow opener, metering mechanism, and calibration; Study, maintenance and operation of tractor; Learning of tractor driving; Study, maintenance and operation of power tiller; Study of different parts, registration, alignment and operation of mower. Study of different inter cultivation equipment in terms of efficiency, field capacity; Repairs and adjustments and operation of sprayers; Repairs and adjustments and operation of dusters; Study of paddy transplanters.

**A501309 PRODUCTION TECHNOLOGY OF VEGETABLES AND FLOWERS** **2**

Importance of Olericulture, vegetable gardens, vegetable classification. Origin, area, production, varieties, package of practices for fruit vegetables –, tomato, brinjal, chillies, and okera; Cucurbitaceous vegetables cucumber, ridge gourd, ash gourd, snake gourd, bottle gourd, bitter gourd and melons, Cole crops – cabbage, cauliflower and knol-khol. Bulb crops – onion and garlic. Beans and peas – French beans, cluster beans, dolichos beans, peas and cowpea. Tuber crops – potato, sweet potato, tapioca, colocasia, yams; Root crops – carrot, radish, turnip and beet root; Leafy vegetables – amaranthus, palak, gogu; Perennial vegetables – drumstick, coccinia and curry leaf.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

Importance of ornamental gardens. Planning of ornamental gardens. Types and styles of ornamental gardens. Use of trees, shrubs, climbers, palms, houseplants and seasonal flowers in the gardens. Package of practices for rose, jasmine, chrysanthemum, crossandra, marigold and tuberose.

**A501310 LAB -PRODUCTION TECHNOLOGY OF VEGETABLES AND FLOWERS 1**

Planning and layout of kitchen garden; 2 Identification of important vegetable seeds and plants; Raising of vegetable nurseries; Identification of ornamental plants (trees ,shrubs,climbers,house plants, palms etc.) and development of garden features; Transplanting of vegetable seedlings in main field; Layout of lawns and maintenance; Seed extraction in tomato and brinjal; Depotting, repotting and maintenance of house plants; Visit to commercial vegetable farms; Training and pruning of rose (standards, hybrid ‘T’ roses cented roses) and chrysanthemum (pinching and disbudding); Planning and layout of gardens and garden designs for public and private areas; Intercultural operations in vegetable plots; Seed production in vegetable crops; Harvesting indices of different vegetable crops; Grading and packing of vegetables; Prolonging the shelflife of cut flowers

**A501311 CROP PHYSIOLOGY 2**

Introduction and importance of crop physiology in agriculture. Seed structure. Morpho-physiological and biochemical changes during seed development. Physiological and harvestable maturity. Seed germination and seed dormancy. Growth and development. Crop water relations. Transpiration and its significance in relation to crop productivity. Water use efficiency. Significance of C3. C4 and CAM pathways. Photorespiration. Photosynthesis and crop productivity. Translocation of assimilates. Source and sink concept. Respiration. its types and significance. Mineral nutrition. Physiology of nutrient uptake. deficiency and toxicity symptoms and hydroponics. Photoperiodism and vernalization. Plant growth regulators-occurrence. Biosynthesis. mode of action and commercial applications. Senescence and abscission. Fruit ripening and its hormonal regulation.

**A501312 LAB - CROP PHYSIOLOGY 1**

Seed structure. germination and seed dormancy. Growth analysis. Calculation of growth parameters. Methods of measuring water status in roots. stems and leaves. Measurement of water potential. Absorption spectrum of chloroplastic pigments. Transpiration. Photosynthesis and respiration. Stomatal frequency and index. Deficiency symptoms of nutrients. Leaf anatomy of C3 and C4 plants.

**A501313 LIVESTOCK PRODUCTION AND MANAGEMENT 2**

Place of livestock in the national economy, different livestock development programmes of Govt. of India. Important exotic and Indian breeds of cattle, buffalo, sheep, goat and swine. Measures and factors affecting fertility in livestock, reproductive behaviour like oestrus, parturition, farrowing etc. Milk secretion, milking of animals and factors affecting milk yield and composition. Selection and breeding of livestock for higher milk and meat production. Feeding and management of calves, growing heifers and milch animals and other classes and types of animals, housing principles, space requirements for different species of livestock. Disease control measures, sanitation and care, breeding, feeding and production records. Breed characteristics of poultry, their methods of rearing, breeding, feeding and management, incubation, hatching and brooding, vaccination and prevention

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

of diseases, preservation and marketing of eggs, its economics and keeping quality. Cost of production of milk, economical units of cattle, buffalo, sheep, goat and swine.

**A501314 LAB - LIVESTOCK PRODUCTION AND MANAGEMENT** **1**

Identification, handling and restraining of animals; Judging and culling; Feeding and ration formulation; Hatching, housing and management of poultry; Visit to livestock farms and Economics of livestock production.

**A501315 AGRICULTURAL FINANCE AND CO-OPERATION** **2**

Agricultural finance: nature and scope. Time value of money, Compounding and Discounting. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4R' s 5C' s and 7 P' s of credit, repayment plans. History of financing agriculture in India. Commercial banks, nationalization of commercial banks. Lead bank scheme, regional rural banks, scale of finance. Higher financing agencies, RBI, NABARD, AFC, Asian Development Bank, World Bank, Insurance and Credit Guarantee Corporation of India. Assessment of crop losses, determination of compensation. Crop insurance, advantages and limitations in application, estimation of crop yields. Agricultural cooperation: philosophy and principles. History of Indian cooperative Movement, pre-independence and post independence periods, cooperation in different plan periods, cooperative credit structure: PACS, FSCS. Reorganization of cooperative credit structure in Andhra Pradesh and single window system. Successful cooperative systems in Gujarat, Maharashtra. Punjab etc.

**A501401 FIELD CROPS-II (RABI)** **2**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *rabi* crops; Cereals: wheat, barley; Pulses: chickpea, lentil, peas, french bean; Oilseeds: rapeseed and mustard, sunflower, safflower and linseed; Sugar crops: sugarcane and sugarbeet, Medicinal and aromatic crops such as mentha, lemon grass, citronella, palma rosa, isabgol and posta; Commercial crops: potato and tobacco, Forage crops: berseem, lucerne and oat.

**A501402 LAB-FIELD CROPS-II (RABI)** **1**

Study of manures, fertilizers and green manure crops. Study of interculture implements. Methods of fertilizer application. Seed bed preparation and sowing of wheat, sugarcane and sunflower. Calculations of seed rate. Identification of weeds in wheat and grain legumes. Morphological characteristics of wheat, sugarcane, chickpea and mustard. Yield components of wheat and sugarcane.

**A501403 BREEDING OF FIELD / HORTICULTURE CROPS** **2**

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Hardy-Weinberg Law; Study in respect of origin, distribution of species, wild relatives and forms, Cereals, (rice, wheat, maize, millets, sorghum, bajra, ragi); Pulses (redgram, greengram, blackgram, soybean); Oilseeds (Groundnut, sesame, sunflower, safflower, castor, mustard) etc. Fibers (Cotton, kenaf, roselle, jute) etc. Vegetables (Tomato, bhindi, chilli, cucumbers); Flowers crops (Chrysanthemum, rose, galardia, gerbera & marigold); Fruit crops

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

(aonla, guava, mango, custard apple, banana, papaya); Major breeding procedures for development of hybrids / varieties of various crops; Plant Genetic Resources their conservation and utilization in crop improvement; Ideotype concept in crop improvement; Breeding for resistance to biotic and abiotic stresses variability in pathogens and pests; Mechanisms of resistance in plant to pathogens and pest; Genetic basis of adaptability to unfavourable environments; Definition of biometrics, assessment of variability i.e., additive, dominance and epistasis and their differentiation; Genotype x Environment interaction and influence on yield/performance. IPR and its related issues.

**A501404 LAB - BREEDING OF FIELD / HORTICULTURE CROPS**

**1**

Emasculation and Hybridization techniques; Handling of segregating generations, pedigree methods; Handling of segregating generations, bulk methods; Handling of segregating generations, back cross methods; Field layout of experiments; Field trials, maintenance of records and registers; Estimation of Heterosis and inbreeding depression; Estimation of Heritability, GCA and SCA; Estimation of variability parameters; Parentage of released varieties/hybrids; Problems on Hardy, Weinberg Law; Study of quality characters; Sources of donors for different characters; Visit to seed production and certification plots; Visit to AICRP trials and programmes; Visit to grow out test plots; Visit to various research stations; Visit to other institutions

**A501405 MANURES, FERTILIZERS AND AGRO-CHEMICALS**

**2**

Introduction – Raw materials – Manures – Bulky and concentrated – FYM, Composts – Different methods, Mechanical compost plants, Vermi-composting, Green manures, Oil cakes, Sewage and sludge – Biogas plant slurry, Plant and animal refuges. Fertilizers – classifications, Manufacturing processes and properties of major nitrogenous (ammonium sulphate, urea, calcium ammonium nitrate, ammonium nitrate, ammonium sulphate nitrate) phosphatic (single super phosphate, enriched super phosphate, di-ammonium phosphate, ammonium poly phosphate), potassic and complex fertilizers their fate and reactions in the soil, Secondary and micronutrients fertilizers, Amendments. Fertilizer Control Order, Fertilizer storage; Biofertilizers and their advantage, Organic chemistry as prelude to agro chemicals, Diverse types of agrochemicals, Botanical insecticides (Neem), Pyrethrum, Synthetic pyrethroids. Synthetic organic insecticides, Major classes, Properties and uses of some important insecticides under each class. Herbicides – Major classes – Properties and uses of 2, 4-D, atrazine, glyphosate, butachlor benthocarb; Fungicides – Major classes – Properties and uses of carbendazim, carboxin, captan, tridemorph and copper oxychloride – Insecticides Act, Plant growth regulators.

**A501406 LAB - MANURES, FERTILIZERS AND AGRO-CHEMICALS**

**1**

Total nitrogen and phosphorus in manures / composts – Ammoniacal and nitrate nitrogen – Water soluble P<sub>2</sub>O<sub>5</sub>, potassium, calcium, sulphur and zinc contents of fertilizers COD in organic wastes – Adulteration in fertilizer. Argentimetric and iodometric titrations – their use in the analysis of lindane metasystox, endosulfan, malathion, copper and sulphur fungicides – Compatibility of fertilizers with pesticides.

**A501407 INSECT ECOLOGY AND INTEGRATED PEST MANAGEMENT**

**2**

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors– temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem. Pest surveillance and pest forecasting. Categories of pests. IPM; Introduction, importance, concepts principles and tools of IPM-Host plant resistance, Cultural, Mechanical, Physical, Legislative, Biological (parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses ) methods of control. Chemical control – importance, hazards and limitations. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Study of important insecticides. Botanical insecticides – neem based products, Cyclo-diols, Organophosphates, Carbamates, Synthetic pyrethroids, Novel insecticides, Pheromones, Nicotinyl insecticides, Chitin synthesis inhibitors, Phenyl pyrazoles, Avermectins, Macrocyclic lactones, Oxadiazimes, Thiourea derivatives, pyridine azomethines, pyrroles, etc. Nematicides, Rodenticides, Acaricides and fumigants. Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation and genetic control. Practices, scope and limitations of IPM. Insecticides Act 1968 – Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning, first aid and antidotes. Beneficial insects: parasites and predators used in pest control and their mass multiplication techniques. Important groups of microorganisms, bacteria, viruses and fungi used in pest control and their mass multiplication techniques. Important species of pollinators, weed killers and scavengers, their importance. Non insect pests – mites, nematology, rodents and birds. Vermiculture

**A501408 LAB - INSECT ECOLOGY AND INTEGRATED PEST MANAGEMENT**

**1**

Visit to meteorological observatory / automatic weather reporting station; Study of terrestrial and pond ecosystems of insects; Studies on behaviour of insects and orientation (repellency, stimulation, deterancy); Study of distribution patterns of insects, sampling techniques for the estimation of insect population and damage; Pest surveillance through light traps, pheromone traps and field incidence; Practicable IPM practices, Mechanical and physical methods; Practicable IPM practices, Cultural and biological methods; Chemical control, Insecticides and their formulations; Calculation of doses/concentrations of insecticides; Compatibility of pesticides and Phytotoxicity of insecticides; IPM case studies; Identification of common phytophagous mites and their morphological characters; Identification of common plant parasitic nematodes and their morphological characters; Identification of rodents and bird pests and their damage; Identification of earthworms in vermiculture – visit to vermiculture unit; Other beneficial insects – Pollinators, weed killers and scavengers

**A501409 AGRICULTURAL MARKETING, TRADE AND PRICES**

**1**

Agricultural Marketing: Concepts and Definition, Scope and subject matter, Market and Marketing: Meaning, Definitions, Components of a market, Classification. Market structure, Conduct, performance. Marketing structure, Market functionaries or agencies, Producer's surplus: Meaning, Types of producers surplus, marketable surplus. Marketed surplus, importance, Factors affecting Marketable surplus. Marketing channels: Meaning, Definition, Channels for different products. Market integration, Meaning, Definition, Types of Market Integration. Marketing efficiency: Meaning, Definition, Marketing costs, Margins and price spread, Factors affecting the cost of marketing, Reasons for higher marketing costs of farm commodities, Ways of reducing marketing costs. Theories of International Trade: Domestic Trade, Free trade, International Trade, GATT, WTO, Implications of AOA. Market access, Domestic support, Export subsidies, EXIM-Policy & Ministerial conferences. Cooperative Marketing. State Trading. Ware Housing



**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

Corporation; Central and State, Objectives, Functions, Advantages. Food Corporation of India: Objectives and Functions. Quality Control, Agricultural Products, AGMARK. Price Characteristics of agricultural product process, Meaning, Need for Agricultural Price Policy. Risk in Marketing: Meaning and importance, Types of Risk in Marketing. Speculations and Hedging, Futures trading, Contract farming.

**A501410 LAB - AGRICULTURAL MARKETING, TRADE AND PRICES 1**

Identification of marketing channels; Study of Rythu Bazars, Regulated markets; Study of unregulated markets; Study of livestock markets; Price spread analysis; Visit to market institutions, NAFED; Study of SWC, CWC and STC; Analysis of information of daily prices; Marketed and marketable surplus of different commodities.

**A501411 PROTECTED CULTIVATION AND POST HARVEST TECHNOLOGY 1**

Green house technology, Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling and heating purposes. Green house equipment, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis. Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies. Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics. Threshing, threshers for different crops, parts, terminology, care and maintenance. Winnowing, manual and power operated winnowers, care and maintenance. Groundnut decorticators, hand operated and power operated decorticators, principles of working, care and maintenance. Maize shellers & castor shellers. Drying, grain drying, types of drying, types of dryers. Storage, grain storage, types of storage structures. Fruits and vegetables cleaning, machinery for cleaning of fruits and vegetables, care and maintenance. Grading, methods of grading, equipment for grading of fruits and vegetables, care and maintenance. Size reduction. Equipment for size reduction care and maintenance. Evaporation, Principle, types of evaporators, quality standards – FAQ, ASTA, FPO, and FDA.

**A501412 LAB -PROTECTED CULTIVATION AND POST HARVEST TECHNOLOGY**

**1**

Study of different types of green houses based on shape, construction and cladding materials; Calculation of air rate exchange in an active summer winter cooling system; Calculation of rate of air exchange in an active winter cooling system; Estimation of drying rate of agricultural products inside green house; Testing of soil and water to study its suitability for growing crops in greenhouses; The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution; The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization; Visit to commercial green houses; Study of threshers, their components, operation and adjustments; Winnowers, their components, operation and adjustments; Study of different components of groundnut decorticator; Study of maize shellers; Study of castor shellers; Study of improved grain storage structure; Study of dryers; Study of cleaners & graders.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

**A501413 DISEASES OF FIELD CROPS AND THEIR MANAGEMENT 2**

Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, sugarcane, turmeric, tobacco, groundnut, sesamum, sunflower, cotton, red gram, Bengal gram, black gram, green gram, tea, soybean.

**A501414 LAB- DISEASES OF FIELD CROPS AND THEIR MANAGEMENT 1**

Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases. Preservation of disease samples survey and collection of diseases of rice, sorghum; Diseases of wheat, bajra & maize; Diseases of sugarcane, turmeric & tobacco; Diseases of groundnut, castor & sunflower; Diseases of sesamum & cotton; Diseases of red gram, green gram, black gram, Bengal gram & beans; Field visits at appropriate time during the semester.

Note: Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester.

**A501415 PRODUCTION TECHNOLOGY OF FRUIT CROPS 2**

Definition and importance of horticulture. Divisions of horticulture. Climatic zones of horticulture crops. Area and production of different fruit crops. Selection of site, fencing, and wind break, planting systems, high density planting, planning and establishment. Propagation methods and use of rootstocks. Methods of training and pruning. Use of growth regulators in fruit production. Package of practices for the cultivation of major fruits – mango, banana, citrus, grape, guava, sapota, apple, litchi. Papaya, Minor fruits – pineapple, annonaceous fruits, pomegranate, ber, fig, phalsa, jack, pear, plum, peaches and cherry.

**A501416 LAB -PRODUCTION TECHNOLOGY OF FRUIT CROPS 1**

Study of horticultural tools and implements and their uses; Containers, potting mixture, potting, depotting and repotting; Plant propagation, seed propagation, scarification, and stratification; Propagation by cuttings (soft wood, hard wood and semi-hardwood) layering (simple layering, Air layering, stooing in guava); Layout and planting systems (Traditional system and high density planting methods); Methods of pruning and training; Training of ber, grape and pomegranate; Pruning of ber, grape, phalsa, fig, apple, pear, peach; Description and identification of varieties of mango, guava, grape, papaya, apple and sapota; Description and identification of varieties of banana, citrus, (lime lemon, sweet orange, mandarin, grape fruit) pomegranate, ber, pear and cherries; Irrigation methods in fruit crops including drip – Micro irrigation methods of establishment of orchard; Methods of Fertiliser application methods in fruit crops including fertigation technology; Visit to local commercial orchards; Preparation of growth regulators, powder, solution and lanolin paste for propagation; Application of growth regulators for improving fruit set, fruit size, quality, delaying ripening and hastening ripening.

**A501501 PRINCIPLES OF PLANT BIOTECHNOLOGY 2**

Concepts of Plant Biotechnology: History of Plant Tissue Culture and Plant Genetic Engineering;

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

Scope and importance in Crop Improvement: Totipotency and Morphogenesis, Nutritional requirements of *in-vitro* cultures; Techniques of In-vitro cultures, Micro propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Test tube fertilization, Endosperm culture, Factors affecting above *in-vitro* culture; Applications and Achievements; Somaclonal variation, Types, Reasons: Somatic embryogenesis and synthetic seed production technology; Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement. Genetic engineering; Restriction enzymes; Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer – Transgenic plants and their applications. Blotting techniques – DNA finger printing – DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop improvement.

**A501502 LAB - PRINCIPLES OF PLANT BIOTECHNOLOGY**

**1**

Requirements for Plant Tissue Culture Laboratory; Techniques in Plant Tissue Culture; Media components and preparations; Sterilization techniques and Inoculation of various explants; Aseptic manipulation of various explants; Callus induction and Plant Regeneration; Micro propagation of important crops; Anther, Embryo and Endosperm culture; Hardening / Acclimatization of regenerated plants; Somatic embryogenesis and synthetic seed production; Isolation of protoplast; Demonstration of Culturing of protoplast; Demonstration of Isolation of DNA; Demonstration of Gene transfer techniques, direct methods; Demonstration of Gene transfer techniques, indirect methods; Demonstration of Confirmation of Genetic transformation; Demonstration of gel-electrophoresis techniques.

**A501503 CROP PESTS AND STORED GRAIN PESTS AND THEIR MANAGEMENT**

**2**

Stored grain pests: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods. Distribution, biology, nature and symptoms of damage, and management strategies of insect and non insect pests of rice, sorghum, maize, ragi (*Eleusine coracana*), wheat, sugarcane, cotton, mesta, sunhemp, pulses, groundnut, castor, gingerly, safflower, sunflower, mustard, brinjal, bhendi, tomato, cruciferous and cucurbitaceous vegetables, potato, sweet potato, colacasia, moringa, amaranthus, chillies, mango, citrus, grapevine, cashew, banana, pomegranate, guava, sapota, ber, apple, coconut, tobacco, coffee, tea, turmeric, betelvine, onion, coriander, garlic, curry leaf, pepper, ginger and ornamental plants.

**A501504 LAB - CROP PESTS AND STORED GRAIN PESTS AND THEIR MANAGEMENT**

**1**

Identification of pests, their damage symptoms and management of rice, sorghum, maize, wheat, sugarcane, cotton, pulses, Solanaceous and Malvaceous vegetables, cruciferous and cucurbitaceous vegetables, chilli, mango, carbon, citrus and sapota.

**A501505 FUNDAMENTALS OF AGRI-BUSINESS MANAGEMENT**

**2**

Agribusiness: Meaning, Definition, Structure of Agribusiness, (Input, Farm, Product Sectors). Importance of Agribusiness in the Indian Economy, Agricultural Policy. Agribusiness Management, Distinctive features, Importance of Good Management, Definitions of Management. Management Functions, Planning, Meaning, Definition, Types of Plans (Purpose or Mission, Goals or Objectives, Strategies, Policies, Procedures, rules, programmes, Budget) characteristics of sound plan, Steps in

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

planning, Organization, Staffing, Directing, Motivation, Ordering, Leading, Supervision, Communication, control. Capital Management. Financial Management of Agribusiness: Importance of Financial Statements, Balance sheet, Profit and Loss Statement, Analysis of Financial statements. Agro-based Industries: Importance and Need, Classification of Industries, Types of Agro-based Industries, Institutional arrangement, Procedure to set up agro-based industries, Constraints in establishing agro-based industries. Marketing Management: Meaning, Definitions, Marketing Mix, 4Ps of Marketing. Mix, Market segmentation, Methods of Market, Product life cycle. Pricing policy, Meaning, pricing method. Prices at various stages of Marketing. Project, definitions, project cycle, Identification, Formulation, Appraisal, Implementation, Monitoring and evaluation, Appraisal and Evaluation techniques, NPW, BCR, IRR, N/K ratio, sensitivity analysis, characteristics of agricultural projects: preparation of project reports for various activities in agriculture and allied sectors: Dairying, poultry, fisheries, agro-industries etc.

**A501506 LAB - FUNDAMENTALS OF AGRI-BUSINESS MANAGEMENT 1**

Study of input markets: seed, fertilizers, pesticides. Study of output markets, grains, fruits, vegetables, flowers. Study of product markets, retail trade commodity trading, and value added products. Study of financing institutions cooperatives commercial banks, RRBs, Agribusiness Finance Limited, NABARD; Preparations of projects, Feasibility reports; Project appraisal techniques; Case study of agro-based industries.

**A501507 DISEASES OF HORTICULTURAL CROPS AND THEIR MANAGEMENT 2**

Economic Importance, symptoms, cause, disease cycle and integrated management of diseases of: citrus, mango, banana, grapevine, pomegranate, papaya, guava, sapota, apple, chilli, brinjal, bhendi, potato, crucifers, cucurbits, tomato, beans, onion, coconut, oil palm, betelvine, mulberry, coffee, tea, rose, chrysanthemum and jasmine.

**A501508 LAB - DISEASES OF HORTICULTURAL CROPS AND THEIR MANAGEMENT 1**

Diseases of beans, citrus, guava, & sapota; Diseases of papaya, banana, pomegranate & ber; Diseases of mango, grapes & apple; Diseases of chilli, brinjal & bhendi; Diseases of potato, tomato & crucifers; Diseases of cucurbits, onion & betelvine; Diseases of oil palm, coconut, tea, coffee & mulberry; Diseases of rose, chrysanthemum and jasmine. Field visits at appropriate time during the semester.

Note: Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester.

**A501509 POST HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES 1**

Importance of post harvest technology in horticultural crops. Maturity indices, harvesting and post harvest handling of fruits and vegetables. Maturity and ripening process. Factors affecting ripening of fruits, and vegetables. Pre harvest factors affecting quality on post harvest shelf life of fruits and vegetables. Factors responsible for deterioration of harvested fruits and vegetables. Chemicals used for hastening and delaying ripening of fruits and vegetables. Methods of storage – precooling, prestorage treatments, low temperature storage, controlled atmospheric storage, hypobaric storage,

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

irradiation and low cost storage structures. Various methods of packing, packaging materials and transport. Packing technology for export. Fabrication of types of containers, cushioning material, vacuum packing, poly shrink packing, specific packing for export of mango, banana, grapes kinnow, sweet orange, and mandarin etc. Importance and scope of fruit and vegetable preservation in India. Principles of preservation by heat, low temperature, chemicals and fermentation. Unit layout – selection of site and precautions for hygienic conditions of the unit. Preservation through canning, bottling, freezing, dehydration, drying, ultraviolet and ionizing radiations. Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials Spoilage of canned products, biochemical, enzymatic and microbial spoilage. Preservatives, Colours permitted and prohibited in India.

**A501510 LAB -POST HARVEST MANAGEMENT AND VALUE ADDITION OF FRUITS AND VEGETABLES** **1**

Practice in judging the maturity of various fruits and vegetables. Conservation of zero energy cool chambers for on farm storage. 3& 4. Determination of physiological loss in weight (PLW), total soluble solids (TSS), total sugars, acidity and ascorbic and content in fruits and vegetables. Packing methods and types of packing and importance of ventilation. Pre cooling packing methods for export or international trade. Methods of prolonging storage life. Effect of ethylene on ripening of banana, sapota, mango, sapota. Identification of equipment and machinery used is preservation of fruits and vegetables. Preservation by drying and dehydration. Preparation of jam, jelly and marmalades. Preparation of squash, cordials and syrups. Preparation of chutneys, pickles sauces and ketchup. Visit to local processing units. Visit to local market yards and cold storage units. Visit to local market and packing industries.

**A501511 PRODUCTION TECHNOLOGY OF SPICES, AROMATIC, MEDICINAL AND PLANTATION CROPS** **1**

Importance and cultivation technology of Spices – ginger, turmeric, pepper, cardamom, coriander, cumin, fenugreek; Aromatic crops – lemon grass, citronella, palmarose, vetiver, geranium, dawana; Plantation crops – coconut, arecanut, betelvine, cashew, cocoa, coffee, oilpalm; Medicinal plants – diascoria, rauvolfia, opium, ocimum, perwinkle, aloe, guggul, belladonna, nuxvomica, Solanum khasiamum , aonla,senna, plantago, stevia,coleus and Acorus.

**A501512 LAB - PRODUCTION TECHNOLOGY OF SPICES, AROMATIC, MEDICINAL AND PLANTATION CROPS** **1**

Botanical description and identification of aromatic plants; Identification of varieties in spices and plantation crops; Identification of medicinal plants; Propagation techniques in aromatic and spice crops; Selection of mother palm, and seed nuts in coconut and oil palm; Study of identification of aromatic plants; Distillation procedures for aromatic crops; Propagation methods in plantation crops; Propagation and planting methods in turmeric; Propagation and planting techniques in ginger; Harvesting procedures in aromatic plants; Processing and curing of spices (ginger, turmeric and black pepper); Training methods in betel vine; Rejuvenation practices in cashew nut; Products – byproducts of spices and plantation crops; Procedures for oleoresin extraction; Visit to local commercial plantations. Aromatic & medicinal plant nurseries and seed spices field.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**A501513 FUNDAMENTALS OF RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY**

2

Extension Education and Agricultural Extension – Meaning, Definition, Scope and Importance. Sociology and Rural Sociology, Meaning, Definition, Scope, Importance of Rural Sociology in Agricultural Extension and Interrelationship between Rural Sociology & Agricultural Extension. Indian Rural Society, Important characteristics, Differences and Relationship between Rural and Urban societies. Social Groups – Meaning, Definition, Classification, Factors considered in formation and organization of groups, Motivation in group formation and Role of Social groups in Agricultural Extension. Social Stratification – Meaning, Definition, Functions, Basis for stratification, Forms of Social stratification – Characteristics and – Differences between Class & Caste System. Cultural concepts – Culture, Customs, Folkways, Mores, Taboos, Rituals and Traditions – Meaning, Definition and their Role in Agricultural Extension. Social Values and Attitudes – Meaning, Definition, Types and Role of Social Values and Attitudes in Agricultural Extension. Social Institutions – Meaning, Definition, Major institutions in Rural society, Functions and their Role in Agricultural Extension. Social Organizations – Meaning, Definition, Types of organizations and Role of Social organizations in Agricultural Extension. Social Control – Meaning, Definition, Need of social control and Means of Social control. Social change – Meaning, Definition, Nature of Social change, Dimensions of social change and factors of social change. Leadership – Meaning, Definition, Classification, Roles of a leader, Different methods of Selection of Professional and Lay leaders. Training of Leaders – Meaning, Definition, Methods of training, Advantages and Limitations in use of local leaders in Agricultural Extension. Psychology and Educational Psychology – Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension. Intelligence – Meaning, Definition, Types, Factors affecting intelligence and Importance of intelligence in Agricultural Extension. Personality – Meaning, Definition, Types, Factors influencing the Personality and Role of personality in Agricultural Extension. Teaching – Learning process – Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics. Principles of learning and their implication for teaching.

**A501514 STATISTICS**

2

Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Median, Mode, Merits and Demerits of Arithmetic Mean; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation; Probability: Definition and concept of probability; Normal Distribution and its properties; Introduction to Sampling: Random Sampling; the concept of Standard Error; Tests of Significance-Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis; Large Sample Test-SND test for Means, Single Sample and Two Samples (all types); Small Sample Test for Means, Student's t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient 'r' and its testing. Linear Regression: of Y on X and X on Y. Inter-relation between 'r' and the regression coefficients, fitting of regression equations. Experimental Designs: Basic Designs, Completely Randomized Design (CRD), Layout and analysis with equal and unequal number of observations, Randomized Block Design (RBD), Layout and analysis, Latin Square Design (LSD), Layout and analysis.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**A501515 LAB- CROP PRODUCTION I (Kharif)**

2

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

**A501601 WEED MANAGEMENT**

2

Weeds: Introduction, harmful and beneficial effects, classification, propagation and dissemination; Weed biology and ecology, crop weed association, crop weed competition and allelopathy Concepts of weed prevention, control and eradication; Methods of weed control: physical, cultural, chemical and biological methods. Integrated weed management; Herbicides: advantages and limitation of herbicide usage in India, Herbicide classification, formulations, methods of application; Introduction to Adjuvant and their use in herbicides; Introduction to selectivity of herbicides; Compatibility of herbicides with other agro chemicals; Weed management in major field and horticultural crops, shift of weed flora in cropping systems, aquatic and problematic weeds and their control.

**A501602 LAB - WEED MANAGEMENT**

1

Identification of weeds; Survey of weeds in crop fields and other habitats; Preparation of herbarium of weeds; Calculations on weed control efficiency and weed index; Herbicide label information; Computation of herbicide doses; Study of herbicide application equipment and calibration; Demonstration of methods of herbicide application; Preparation of list of commonly available herbicides; Study of phytotoxicity symptoms of herbicides in different crops; Biology of nut sedge, bermuda grass, parthenium and celosia; Economics of weed control practices; Tours and visits of problem areas.

**A501603 PRODUCTION ECONOMICS AND FARM MANAGEMENT**

2

Production Economics: Meaning, Definition, Nature and Scope of Agricultural Production Economics. Basic concepts and terms. Concepts of Production. Production Functions: Meaning, Definition, Types. Laws of returns: Increasing, Constant and decreasing. Factor Product Relationship. Determination of optimum input and output. Factor relationship. Product relationship. Types of enterprise relationships. Returns to scale: Meaning, Definition, Importance. Farm Management. Economic principles applied to the Organizations of farm business. Types and systems of farming. Farm planning and budgeting. Risk and uncertainty. Farm budgeting. Linear programming: Assumptions, Advantages and Limitations of Linear programming.

**A501604 LAB - PRODUCTION ECONOMICS AND FARM MANAGEMENT**

1

Computation of cost concepts; Methods of computation of depreciation; Analysis of Net worth statement; Farm inventory analysis; Preparation of farm plans and budgets; Types of farm records and accounts; Preparation of profit and loss account; Break, Even analysis; Economics analysis of different crop and livestock enterprises; Application of Farm Management Principles.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**A501605 RENEWABLE ENERGY**

1

Energy sources, Introduction, Classification, Energy from Biomass, Types of biogas plants, constructional details, Biogas production and its utilization, Agricultural wastes, Principles of combustion, pyrolysis and gasification, Types of gasifiers, Producer gas and its utilization. Briquettes, Types of Briquetting machines, uses of Briquettes, Shredders. Solar energy, Solar flat plate and focusing plate collectors, Solar air heaters, Solar space heating and cooling, Solar energy applications / Solar energy gadgets, Solar cookers, Solar water heating systems, solar grain dryers, Solar Refrigeration system, Solar ponds, Solar photo voltaic systems, solar lantern, Solar street lights, solar fencing, Solar pumping systems. Wind energy, Types of wind mills, Constructional details & application of windmills. Liquid Bio fuels, Bio diesel and Ethanol from agricultural produce, its production & uses.

**A501606 LAB - RENEWABLE ENERGY**

1

Constructional details of KVIC & Janatha type biogas plants; Constructional details of Deen Bandu type biogas plants; Field visit to biogas plants; Constructional details of different types of gasifiers; Testing of gasifiers; Briquette preparation from biomass; To study and find the efficiency of solar cooker; To study and find the performance of a solar still; To study and find the performance of a solar dryers; Study and working of solar photovoltaic pumping system; Study and performance evaluation of domestic solar water heater; Study and performance evaluation of solar lantern; Study and performance evaluation of solar street light; To study the performance of different types of wind mills; Field visit to wind mills; To study the processing of Bio-diesel production from Jatropha.

**A501607 EXTENSION METHODOLOGIES FOR TRANSFER OF AGRICULTURAL TECHNOLOGY**

2

Communication – Meaning, Definition, Models, Elements and their Characteristics, Types and Barriers in communication. Extension Programme Planning – Meaning, Definitions of Planning, Programme, Project, Importance, Principles and Steps in Programme Development Process, Monitoring and Evaluation of Extension Programmes. Extension Teaching methods – Meaning, Definition, Functions and Classification. Individual contact methods – Farm and Home visit, Result Demonstration, Field trials – Meaning, Objectives, Steps, Merits and Demerits. Group contact methods – Group discussion, Method demonstration, Field Trips – Meaning, Objectives, Steps, Merits and Demerits. Small group discussion techniques – Lecture, Symposium, Panel, Debate, Forum, Buzz group, Workshop, Brain Storming, Seminar and Conference. Mass contact Methods – Campaign, Exhibition, Kisan Mela, Radio & Television – Meaning, Importance, Steps, Merits & Demerits. Factors influencing in selection of Extension Teaching Methods and Combination (Media Mix) of Teaching methods. Innovative Information sources – Internet, Cyber Cafes, Video and Tele conferences, Kisan call centers, Consultancy clinics. Agricultural Journalism – Meaning, Scope and Importance, Sources of news, Types, Merits and Limitations. Diffusion and Adoption of Innovations – Meaning, Definition, Models of adoption Process, Innovation – Decision Process – Elements, Adopter categories and their characteristics, Factors influencing adoption process. Capacity building of Extension Personnel and Farmers – Meaning, Definition, Types of training, Training to farmers, farm women and Rural youth – FTC and KVK.



**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

**A501608 LAB - EXTENSION METHODOLOGIES FOR TRANSFER OF AGRICULTURAL TECHNOLOGY** **1**

Simulated exercises on communication. Identifying the Problems, Fixing the Priorities and selecting a most important problem for preparation of a project. Developing a project based on identified problems in a selected village. Organization of Group discussion and Method demonstration. Visit to KVK / FTC. Planning and Writing of scripts for Radio and Television. Audio Visual aids – Meaning, Importance and Classification. Selection, Planning, Preparation, Evaluation and Presentation of visual aids. Planning & Preparation of visual aids – Charts, Posters, Over Head Projector, (OHP) Transparencies, Power Point Slides. Planning and Preparation of Agricultural Information materials – Leaflet, Folder, Pamphlet, News Stories, Success Stories. Handling of Public Address Equipment (PAE) System, Still camera, Video Camera and Liquid Crystal Display (LCD) Projector.

**A501609 ENTREPRENEURSHIP DEVELOPMENT AND COMMUNICATION SKILLS** **1**

Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalisation and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to agriculture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of agri inputs industry. Characteristics of Indian agricultural processing and export industry. Social Responsibility of Business. Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal 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, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

**A501610 LAB -ENTREPRENEURSHIP DEVELOPMENT AND COMMUNICATION SKILLS** **1**

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, précis writing, summarizing, abstracting; individual and group presentations.

**A501611 BIOCHEMISTRY** **2**

Biochemistry – Introduction and importance. Plant cell, cell wall and its role in live stock, food and paper industries. Bio-molecules – Structure, properties & applications: Amino acids, peptides and proteins –Plant proteins and their quality. Enzymes –Factors affecting the activity, classification, Immobilisation and other industrial applications. Lipids –Acyl lipids, Their industrial application in

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

soaps, detergents, paints, Varnishes, lubricants, adhesives, plastics, nylon, Bio-diesel, Biodegradable plastics etc. Carbohydrates; Nucleotides and Nucleic acids. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation. General reactions of amino acid degradation. Biosynthesis – carbohydrates, Lipids, Proteins and Nucleic acids. Metabolic regulation. Secondary metabolites, Terpenoids, Alkaloids, Phenolics and their applications in food and pharmaceutical industries.

**A501612 LAB – BIOCHEMISTRY**

**1**

Amino acid models (atomic); Paper electrophoresis for the separation of plant pigments; Protein denaturation – heat, pH, precipitation of proteins with heavy metals, Protein estimation by Lowry method; Enzyme kinetics, competitive inhibition, enzyme immobilization; Extraction of nucleic acids, column chromatography of RNA hydrolysate; Characterization of lipids by T.L.C.; Extraction of oil from oil seeds; Estimation of fatty acids by G.L.C.; Models of sugars, sucrose & starch; Quantitative determination of sugars; Paper chromatography for the separation of sugars; Determination of phenols.

**A501613 ENVIRONMENTAL SCIENCE**

**2**

Scope and importance of environmental studies. Natural resources: Renewable and non-renewable resources. Forest, Water, Food, energy and land resources. Ecosystems: Definition, concept, structure and functions. Producers, consumers and decomposers of an ecosystem. Energy flow in the ecosystem. Types of ecosystems. Bio-diversity: Definition, classification, threats to biodiversity and its conservation. Environmental pollution: Causes, effects and control of air, water, soil, thermal, noise and marine pollution. Causes, effects and management of soil nuclear hazards and industrial wastes. Disaster management, Floods, earthquakes, cyclones and land slides. Social issues and the environment, unsustainable to sustainable development. The Environment Protection Act, The Air Act, The water Act, The Wildlife Protection Act and Forest Conservation Act. Woman and child welfare, HIV/AIDS and Role of information technology on environment and human health.

**A501614 ORGANIC FARMING**

**1**

Introduction, concept, relevance in present context; Organic production requirements; Biological intensive nutrient management-organic manures, vermicomposting, green manuring, recycling of organic residues, biofertilizers; Soil improvement and amendments; Integrated diseases and pest management – use of biocontrol agents, biopesticides pheromones, trap crops, bird perches; Weed management; Quality considerations, certification, labeling and accreditation processors, marketing, exports.

**A501615 LAB-CROP PRODUCTION II (Rabi)**

**2**

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

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**GROUP- I CROP PRODUCTION**

**501701 SEEDPRODUCTION TECHNOLOGY****2**

Introduction, importance, impact of seed production technology on production and productivity of crops. Definition of seed, seed technology and quality parameters of seed. Different classes of seed and its production. Seed certification, state seed certification agency, inspection. Seed viability, seed vigour seed dormancy, and breaking of dormancy. Varietal identification through grow-out tests and electrophoresis. Seed production of commercial and different classes of seed varietal and hybrid seed production of major self and cross pollinated crops. Seed processing including drying, cleaning, grading, testing, packing and labeling.

**501702 LAB- SEEDPRODUCTION TECHNOLOGY****1**

Seed treatment and equipment used for seed treatment (Slurry and Mist-o-Matic-Treater). Seed packing and storage methods. Factors affecting seed longevity during storage and conditions required for storage. Tests of seed vigour and viability. Pest and disease control, temperature control. Seed marketing. Grow out tests. Seed germination tests.

**501703 INTEGRATED FARMING SSSTEM AND SUSTAINABLE AGRICULTURE****2**

Farming systems, definition, principles and components. Farming System models for irrigated, dryland situations and modules for marginal, small and large farmers. Farming systems of the world-arable, pastoral, lay farming, shifting cultivation, ranching and agro-forestry systems. Energy and fuel wood plantations. Specialized and diversified farming, family co-operative and collective farming: their occurrence, adaptations and weaknesses. Factors affecting choice of farming systems. Cropping systems, their characteristics and management. Cropping patterns. Agro-ecosystem and agro-ecological zones of India. Efficient food producing systems. Sustainable agriculture- Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures, land degradation and conservation of natural resources.

**501704 LAB- INTEGRATED FARMING SSSTEM AND SUSTAINABLE AGRICULTURE**

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

**501705 PRODUCTION OF COMMERCIAL CROPS****2**

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield and processing of commercial crops, cotton, maize,, jute , sunhemp, soybean, sugarcane, sugarbeet, potato ginger, turmeric, mentha etc.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

**501706 LAB- PRODUCTION OF COMMERCIAL CROPS** **1**

Cultural practices for commercial crops. Effect of seed size and sowing depth on germination. Morphological characteristics of commercial crops. Identification of weeds of commercial crops. Identification propagation, seed selection, seed treatment, processing and distillation techniques for different medicinal, aromatic and spice crops.

**501707 SOIL FERTILITY AND NUTRIENT MANAGEMENT** **2**

Crop response to fertilizer-effect on germination, growth and nutrient removal. Problems of supply and availability of nutrients, relation between nutrient supply and crop growth. Integrated nutrient management. Preparation and use of farmyard manure, compost, green manures, vermi-compost, bio-fertilizers and other organic concentrates their composition, availability and crop responses, recycling of organic wastes and residue management. Commercial fertilizers, composition, relative fertilizer value and cost. Crop response to different nutrients, residual effects and fertilizer use efficiency, fertilizer mixtures and grades. Nutrient interactions. Time and methods of manures and fertilizers application. Foliar fertilizer application and its concept. Relative performance of organic and inorganic manures. Economics of fertilizer use. Site specific nutrient management. Effect of fertilizers on environment, Nutrient cycling integrated farming systems, Long effects of fertilizers use on crop yield and soil productivity.

**501708 LAB-SOIL FERTILITY AND NUTRIENT MANAGEMENT** **1**

Principles of analytical instruments and their calibration and applications, Colorimetry and flame photometry Soil, plant , manure and fertilizer analysis for macro and micro nutrients

**501709 MANAGEMENT OF PROBLEM SOILS AND WATER** **2**

Area, distribution, origin and basic concepts of problematic soils. Morphological features and characterization of salt-affected soils. Management of salt- affected soils. Salt tolerance of crops - mechanism and ratings. Monitoring of soil salinity in the field. Management principles for sandy, clayey, red lateritic and dry land soils. Acid soils – nature, sources and management. Effect on plant growth. Lime requirement of acid soils. Biological sickness of soils and its management. Quality of irrigation water, management of brackish water. Salt balance under irrigation. characterization of brackish waters, area and extent. Agronomic practices in relation to problematic soils. Cropping pattern for utilizing poor quality ground waters.

**501710 LAB- MANAGEMENT OF PROBLEM SOILS AND WATER** **1**

Characterization of acid, acid sulfate, salt- affected and calcareous soils. Determination of cations (Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>+</sup>, and Mg<sup>++</sup>) in ground water and soil samples. Determination of anions (Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, CO<sub>3</sub><sup>2-</sup> and HCO<sub>3</sub><sup>-</sup>) in ground waters and soil samples. Lime and gypsum requirement of acid and sodic soil.

**501711 LAB- ANALYTICAL TECHNIQUES IN SOIL, PLANT, FERTILIZER AND WATER ANALYSIS** **2**

Colorimetric and flame photometric methods. Atomic absorption spectrophotometry. Cation and

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

anion exchange phenomenon and their importance. Ion adsorption, desorption and fixation in soils. Fertilizer control order. Planning and formulation of project on establishment of soil water and plant testing laboratory. Preparation of standard solutions. Collection and analysis of soil, water, plant and fertilizer samples. Soil, water and fertilizer analysis reports for recommendation purposes. Analysis of forms of nitrogen, phosphorous, potassium and sulphur in soils. Determination of DTPA extractable micronutrients. Plant analysis for total N, P, K and micro-nutrients.

**501712 PRODUCTION TECHNOLOGY OF ECONOMIC FOREST TREES 2**

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

**501713 LAB- PRODUCTION TECHNOLOGY OF ECONOMIC FOREST TREES**

**1**

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

**GROUP - II CROP PROTECTION**

**501714 APICULTURE**

**1**

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

**501715 LAB- APICULTURE**

**2**

Important species of honey bees, castes differentiation and body structure. Handling of colonies. Colony organization and food storage pattern. Langstroth hive, apicultural equipment and machinery. Bee flora. Seasonal management practices. Colony division. Mass queen bee rearing techniques. Queen introduction, clipping and marking. Bee pollination of crops. Management of bacterial, viral and fungal diseases of honey bees. Identification and management of parasitic mites, wax moths, ants, wasps and predatory birds. Honey extraction. Pollen, propolis and bee venom

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

collection. Processing of bees wax. Royal jelly production and collection. Honey processing and packaging. Honey testing. Visit to beekeeping industry (Hive manufacturing, equipment manufacturing, honey processing and exporting commercial units).

**501716 BIOCONTROL AND INTEGRATED PEST MANAGEMENT 2**

History and concept of biological control, different groups of biological control agents and biopesticides- macrobials (parasitoids and predators), microbials (bacteria, viruses, fungi, protozoa and nematodes) and botanical- neem, pyrethrum, nicotine, rotenone and others, their use in pest management along with advantages and limitations. Methods of mass production for each of these groups. National and international agencies dealing with biological control. IPM- history, definition and concept. Concept of economic threshold. Pest monitoring and surveillance. Different tools of IPM including physical, mechanical, resistance, botanical, chemical, biorationals and biotechnological approaches. Integration of different IPM tactics. Decision making systems. Potential of IPM, its implementation and constraints. Successful example in IPM.

**501717 LAB- BIOCONTROL AND INTEGRATED PEST MANAGEMENT 1**

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

**501718 PESTICIDES AND PLANT PROTECTION EQUIPMENT 2**

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

**501719 LAB- PESTICIDES AND PLANT PROTECTION EQUIPMENT 1**

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

**501720 LAB- PLANT DISEASE DIAGNOSIS 2**

Field diagnosis of important diseases of *Rabi* and *Kharif* crops, vegetables, fruits, forest and ornamental plants. Estimation of losses and methods for assessing the intensity of diseases like angular leaf spot of cotton, *Tikka* disease of groundnut, yellow mosaic of beans, downy mildew of *bajra*, rusts and loose smut of wheat, *Alternaria* blight, downy mildew of mustard and powdery mildew of pea. Methods of soil sterilization for raising healthy nursery plants. Solarheat

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

treatment. Methods of producing virus-free citrus and potato. Diagnosis and differentiation of disorders due to viruses, nutritional imbalances, genetic variations and toxaeimias. Types of chemicals used for the control of plant diseases and methods of their application. Cultural and biological methods of plant disease control.

**501721 BIOCONTROL AND INTEGRATED DISEASE MANAGEMENT 2**

History and principles underlying host resistance, chemical, physical, cultural, biological and legislative measures of plant disease management. Scope and factors affecting biological control. Mechanisms of bio-control. Characterization of bioagents and their commercial formulations. Limitations of bio-control. Commercial production and distribution system. Integrated disease management. Historical developments and classification of fungicides and antibiotics. Mode of action, uptake, translocation, disease control and factors affecting their efficacy and field performance. Registration, commercial development and compatibility of fungicides with other chemicals. General account of plant protection appliances. Development of resistance in pathogens against fungicides. Non-target effects of fungicide use. Methods of screening for disease resistance. Seed certification standards and phytosanitary measures.

**501722 LAB- BIOCONTROL AND INTEGRATED DISEASE MANAGEMENT 1**

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

**501723 POST HARVEST DISEASES AND THEIR MANAGEMENT 2**

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

**501724 LAB- POST HARVEST DISEASES AND THEIR MANAGEMENT 1**

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

**501725 LAB- MUSHROOM PRODUCTION 3**

Introduction to mushrooms and mushroom growing. Characteristics of mushrooms and their identification. Cultivation techniques of *Agaricus bisporus*, *Pleurotus* spp. *Volvariella* spp. and *Calocybe* spp. Processing of raw materials and compost methodology, spawn production and spawning, casing materials, their treatment and use. Crop management practices including control of pathogens. Designing a mushroom house. Project report formulation at farm level

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**GROUP - III HORTICULTURE**

**501726 NURSERY MANAGEMENT OF HORTICULTURAL CROPS 2**

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

**501727 LAB- NURSERY MANAGEMENT OF HORTICULTURAL CROPS 1**

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

**501728 COMMERCIAL FRUIT PRODUCTION 2**

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

**501729 LAB- COMMERCIAL FRUIT PRODUCTION 1**

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

**501730 PROCESSING AND VALUE ADDITION OF FRUITS AND VEGETABLES 3**

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

**501731 LAB- PROCESSING AND VALUE ADDITION OF FRUITS AND VEGETABLES 1**

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



**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

**501732 COMMERCIAL VEGETABLE PRODUCTION 2**

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

**501733 LAB- COMMERCIAL VEGETABLE PRODUCTION 1**

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

**501734 VEGETABLE BREEDING AND SEED PRODUCTION 2**

Scope of vegetable breeding and seed production. Origin, floral biology and breeding systems in vegetable crops. Germplasm resources. Principles and methods of breeding self-pollinated, often cross-pollinated and cross-pollinated vegetable crops. Plant introduction, selection, hybridization, population improvement, mutation and polyploidy. Seed production of conventional varieties. Production of F1 hybrids using male sterility, self-incompatibility, various sex-forms etc. Methods of production of nucleus, breeder, foundation and certified seeds isolation, pollination, seed harvesting, processing and storage. Seed testing and certification. Seed Act. Vegetable seed industry and its problems.

**501735 LAB- VEGETABLE BREEDING AND SEED PRODUCTION 1**

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

**501736 FORCING TECHNIQUES IN VEGETABLE PRODUCTION 1**

Objectives, importance and scope of protected cultivation. Nursery raising techniques. Environmental factors. Vegetable growing media. Irrigation and fertigation. Sustainable land use systems. Maximising land use efficiency in protected structures. Problems of growing vegetables in protected structures,. Soil sterilization techniques. Hydroponics cultivation. . Pest management in green house / glass house. Crops and varieties suitable for protected cultivation. Specific technology for raising tomato, sweet pepper, cucumber and high value crops in off season. Cladding material for protected structures – use of mulches. Seed production of vegetables.

**501737 LAB- FORCING TECHNIQUES IN VEGETABLE PRODUCTION 1**

Study of various types of structures. Methods to control temperature, CO<sub>2</sub>, light. Demonstration for sanitation measures. Hydroponics. Maintenance of parental lines and hybrid seed production in glasshouse. Fertigation and nutrient management. Control of diseases and insect pests in glasshouse. Visit to established greenhouses in the region.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**501738 COMMERCIAL FLORICULTURE AND LANDSCAPING 1**

Scope, importance and export potential of floriculture, environment factors influencing plant growth and flower production in cut flowers. Production technology including varieties, propagation, soil, nutrition, disease and pests of important cut flowers. Post harvest handling, grading and packing cut flowers, pot and bedding plants. Flower seed production. History of gardening, characteristics of Hindu, Mughal, Japanese and English gardens. Principle groups of plants like trees, shrubs, climbers, shade loving plants, ground covers, their analysis and use in landscape composition. Principles of art and landscaping. Preparation of landscape plans for homes, farm complexes, small parks and institutions. Development and maintenance of rock, water and terrace gardens. Bonsai and dish gardens, project formulation and evaluation.

**501739 LAB- COMMERCIAL FLORICULTURE AND LANDSCAPING 1**

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

**GROUP- IV PLANT BREEDING AND GENETICS**

**501740 GENETICS OF CROP PLANTS 2**

Genetic analysis in different systems. Genetic recombination in prokaryotes and eukaryotes. Detection and estimation of linkage from test cross and F<sub>2</sub> data. Genetic material - organization, structure and replication. Extra nuclear inheritance. Genetic of quantitative traits. Genetic equilibrium and forces changing gene frequency. Induction, detection and uses of mutations. Gene function. Gene expression. Gene regulation. Environmental influence on gene expression. Gene cloning. Genetic transformation.

**501741 LAB- GENETICS OF CROP PLANTS 1**

Study of autosomal monogenic and digenic inheritance. Three point test cross and gene mapping. Detection and estimation of linkage using test cross and F<sub>2</sub> data. Segregation in corn. Gene frequency analysis - autosomal, sex-linked and multiple allelic traits. Genetic equilibrium. Demonstration of quantitative inheritance.

**501742 CYTOGENETICS OF CROP PLANTS 2**

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

**501743 LAB- CYTOGENETICS OF CROP PLANTS 1**

Microscopy. Techniques of cytological preparations. Fixation of material for mitosis

**GURU KASHI UNIVERSITY  
UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

and meiosis. Preparation of permanent slides of cell division. Karyotype analysis. Production and study of polyploids and haploids. Identification of aneuploids.

**501744 THEORY AND PRACTICE OF PLANT BREEDING 2**

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

**501745 LAB- THEORY AND PRACTICE OF PLANT BREEDING 1**

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

**501746 INTRODUCTION TO BREEDING OF FIELD CROPS 3**

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

**501747 CROP EXPERIMENTATION 1**

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

**501748 LAB- CROP EXPERIMENTATION 1**

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

**501749 PRINCIPLES AND PROCEDURES OF PLANT TISSUE CULTURE AND TRANSFORMATION 2**

Concepts of plant tissue culture and transformation. Various aspects of plant tissue culture. GMO's / LMO's/ transgenics. Gene transfer methods. *Agrobacterium* mediated plant transformation. Particle gun mediated plant transformation. Molecular characterization of

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**

**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

transgenic plants using PCR, Southern and Western analysis. Bioassays with transgenic plants. Genetic engineering of crop plants for useful traits. Foods for the future. Biosafety concerns and regulatory mechanisms. Commercialization of transgenic products.

**501750 LAB- PRINCIPLES AND PROCEDURES OF PLANT TISSUE CULTURE AND TRANSFORMATION** **1**

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

**501751 PRINCIPLES AND PROCEDURE OF MOLECULAR BIOTECHNOLOGY AND GENOMICS** **2**

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

**501752 LAB- PRINCIPLES AND PROCEDURE OF MOLECULAR BIOTECHNOLOGY AND GENOMICS** **1**

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

**GROUP - V POST HARVEST TECHNOLOGY AND VALUE ADDITION**

**501753 FRUIT AND VEGETABLE TECHNOLOGY** **2**

Present status and scope of Fruit & Vegetable Industry in India. Principles and preservation of fruits and vegetables by thermal processing, low temperature, chemicals, irradiation, salt, sugar and high pressure. Preparation of jams, jellies, marmalades, juices, squashes, ketchup, pickles, chutneys, wine and vinegar. Role of pectin in gel formation. Quality characteristics of fruit and vegetable products. Selection of site, design, layout, equipment, machinery and buildings. Plant sanitation. Disposal of wastes from fruit and vegetable processing plants. Project formulation and evaluation.

**501754 LAB- FRUIT AND VEGETABLE TECHNOLOGY** **1**

Canning of fruits and vegetables. Dehydration of fruits and vegetables. Preparation of fruit juices, squashes, jams, jellies, marmalades, ketchup, pickles, chutneys, preserve, candy, wine and vinegar. Organoleptic evaluation of fruit and vegetable products. Visit to food industry.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**501755 DAIRY TECHNOLOGY**

2

Physico - chemical properties of milk. Liquid milk processing – clarification, pasteurization, homogenization, chilling and packaging. Fluid milk – toned, double toned, standardized, recombined and reconstituted. Fermented milks – natural, cultured buttermilk, acidophilus, bulgaricus, kafir and koumiss. Preparation of milk products-cheese, condensed and evaporated milks. Whole and skim milk powder and ice cream. Legal and BIS standards of milk and milk products. Plant sanitation and affluent disposal. Utilization of by-products. Dairy plant layout and project formulation.

**501756 LAB- DAIRY TECHNOLOGY**

1

Quality evaluation of fluid milk. Detection of adulteration in milk and milk products. Preparation of milk products – cheese, flavoured pasteurized, sterilized and fermented milk, ice cream, yoghurt, khoa and paneer. Visit to milk plant.

**501757 CEREAL TECHNOLOGY**

2

Structure of different grains-wheat, rice, barley, oat, corn and millets. Milling of grains. Flour and its use in bakery products- bread, biscuits, cakes, dough nuts and buns. Milling and parboiling of paddy. Rice bran oil. Pearling and malting of barley. Preparation of oat flakes and dalia. Wet and dry milling of corn. Preparation of extruded products. Sanitation of cereal processing plant. Project formulation and evaluation.

**501758 LAB- CEREAL TECHNOLOGY**

1

Determination of quality characteristics of wheat, wheat flour and atta. Rice milling and parboiling. Pearling and malting of barley. Preparation of chapaties, bread, biscuits, cakes, buns, rusks, flat bread, broken wheat i.e. porridge, puffed and extruded products.

**501759 EGG AND MEAT TECHNOLOGY**

2

Structure, composition, nutritive value and functional properties of eggs. Interior quality of eggs and its preservation. Preparation of egg products. Scope of meat and poultry processing industry in India. Slaughtering and dressing of poultry and other meat animals. Structure, composition, nutritive value and post-mortem bio-chemical changes in relation to quality of meat tissues. Meat tenderization. Principles of meat preservation. Standards and quality control measures for meat and poultry processing plant. By-products. Plant layout and project formulation.

**501760 LAB- EGG AND MEAT TECHNOLOGY**

1

Evaluation of quality and grading of eggs. Preservation of shell eggs. Preparation of various egg products. Slaughtering and dressing of poultry and meat animals. Preparation of meat cuts. Chilling and ageing of meat. Estimation of meat: bone ratio. Preparation of meat-products canned, dehydrated, barbecued and comminuted. Preparation of sausages, loaves, burger, patties, fish fingers, kabab and restructured meat and poultry products.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**501761 FUNDAMENTALS OF FOOD BIOCHEMISTRY 2**

Biochemistry of food constituents such as water, lipids, proteins, carbohydrates, minerals, vitamins, enzymes, tannins, colouring and flavouring components. Milk and milk products, fruits and vegetables, meat and poultry products, cereals and pulses. Chemistry and rheology of food-stuffs such as fat globules. Dough systems, syrups, juices, jams and jellies. Effect of processing on food constituents. Food standards.

**501762 FUNDAMENTALS OF FOOD MICROBIOLOGY 2**

Introduction and historical development of food microbiology. Food spoilage - sources and prevention by physical and chemical means. Microbiology of food - cereals, meat, poultry, egg, fruits, vegetables, milk, milk products, salt, sugar, etc. Role of microorganisms in fermented foods - bread, malt beverages, wine, vinegar, butter and cheese etc. Microbial enzymes in food processing. Waste water from food industries. Quality control of processed food. Pathogenic bacteria in milk and milk products. Food poisoning and its control.

**501763 LAB- FUNDAMENTALS OF FOOD MICROBIOLOGY 1**

Microbiological examination of various foods - fruits, vegetables, eggs, meat, milk and milk products. Starter culture - preparation, evaluation and applications. Microbiological analysis of water.

**501764 ENGINEERING PRINCIPLES IN FOOD PROCESSING 3**

Unit and Dimensions. Material and energy balances, Size reduction and related energy laws, cleaning, grading, sorting, mixing and material handling. Elementary fluid dynamics and statics, heat transfer, exchanger and psychrometrics. Principles of thermal processing, pasteurization, sterilization, refrigeration, freezing, evaporation, dehydration and centrifugal separation.

**501765 LAB- ENGINEERING PRINCIPLES IN FOOD PROCESSING 1**

Temperature and moisture content measurements. Performance characteristics of size reduction, separating, mixing and drying equipment. Study of parallel and counter current heat exchangers. Enthalpy calculations of a vat pasteurizer. Energy auditing and canning operations. Determination of boiling point rise in concentrated solutions. Measurement of water activity of foods

**GROUP - VI AGRI-BUSINESS AND EXTESION MANAGEMENT**

**501766 FINANCIAL AND PROJECT MANAGEMENT 3**

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

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**

projects. Project feasibility- market, technical, financial and economic feasibility. Project risk analysis. Estimating financial requirements of projects and sources of finance.

**501767 LAB- FINANCIAL AND PROJECT MANAGEMENT 1**

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

**501768 RETAILING AND SUPPLY CHAIN MANAGEMENT 3**

Introduction to retailing- definition, concept and overview. Types of retail institutions related to agri-business. Changing food consumption patterns in India. Store location and site selection. Managing retail operations procurement and inventory management. Store design- the exterior, interior, layout and display. Promoting store. Introduction to customer relationship management in retail business. Supply chain management- concept, definition and importance. Elements of physical distribution systems, building and operating supply chains in agribusiness. Role of IT in supply chain management.

**501769 MICRO ECONOMIC ANALYSIS 3**

Micro Economics: meaning, definition, importance, nature and scope. Theory of consumer behavior: marginal utility analysis and indifference curve analysis. Demand analysis: meaning, definition, derivation of demand curve. Firm and industry: meaning, types, difference between firm and industry, equilibrium conditions, short-run and long-run analysis. Production: meaning, process and factors of production, relationship between production and different factors, production lags. Theory of producer behaviour: production function, costs, optimization of inputs use and product combinations, maximization of returns, specialization and diversification and supply analysis. Product market: meaning, types, assumptions, conditions of perfect and imperfect markets. Equilibrium of a firm and industry, determination of price and output of commodities under different market situations. Factor pricing: meaning, different theories for determination of rent, wages, interest and profit.

**501770 MACRO ECONOMIC ANALYSIS 3**

Macro Economics: meaning, definition, importance, limitations, scope and integration of micro and macro analysis. Basic macroeconomic concepts. National income: meaning, definition, types, measurement and social accounting. Circular flow of money. Simple Keynesian model of income determination. Shifts in aggregate demand and multiplier. Theories of consumption and investment. Income determination model including money and interest. Monetary policy: meaning, instruments, indicators, lags and effectiveness. Fiscal policy: meaning, definition, different tools and limitations. Wage and employment policies: meaning, need, demand and supply of labour, measures of full employment, relationship between level of employment and output. Inflation and recession: process, causes, types and remedies. Introduction to Indian economy and comparison with other related economies. Significant economic problems in Indian agriculture relating to agricultural production and productivity, credit, marketing, labour and environment.

**GURU KASHI UNIVERSITY**  
**UNIVERSITY COLLEGE OF AGRICULTURE**  
**BACHELOR OF AGRICULTURE SCIENCE (HONS.) 4 YEARS**  
**501771 ADMINISTRATION OF AGRICULTRE EXTENSION PROGRAMMES** **2**

Contributors to agricultural development - Scientific technology and its dissemination; inputs, finance, marketing, processing of farm produce and conductive policies. Leadership - types and theories Identification and role of key - communicators opinion leaders in dissemination of scientific technology among farmers. Qualities of a good extension worker. Planning and implementation of agricultural extension projects.

**501772 COMMUNICATION AND EXTENSION TEACHING METHODS** **3**

Communication - Concept and importance in Agricultural Extension Elements of Communication process - Sender, Message, Channel, message treatment and receiver and their role in improvement of communication fidelity / effectiveness. Teaching - learning process as applicable in agricultural extension individual group and mass contact extension teaching methods - their choice and use under different field situations. Role of application of computer in production and presentation of audio, visual and audio-visual aids. Cyber extension its role and application.

**501773 BEHAVIOUR SKILLS FOR HUMAN RESOURCE DEVELOPMENT** **2**

Concept of human behaviour. Taxonomy of behavioural domains. Human needs and their hierarchy. Attitude, its characteristics and measurement. Perception and its principles, selectivity in perception. Motivational skills for attitudinal and perceptual changes. Problem-solving skills. Innovativeness in human behaviour, response and resistance to change. Concept of self, Johari's window model. Defence mechanism. Group dynamics. Group behaviour and conflict management. Decision-making process. Concept of human resource development and human relations. Human interaction, its importance and types. Interpersonal perception and social behaviour.

**SEMESTER 8**

**RURAL AGRICULTURAL WORK EXPERIENCE** **0+20**

After the completion of course work, the students of B.Sc. Agri. (Hons.) will receive training under the compulsory RAWE programme for 20 weeks. The students will attend the one day orientation each in electives: (a) Crop production; (b) Crop Protection . (c) Horticulture; (d) Plant Breeding, and Genetics (e) Post Harvest Technology and Value addition (f) Agri-business Management. The students will attend three weeks Village Attachment Training. Further, they will undergo 12 weeks on-campus training in: (a) Bee-keeping; (b) Mushroom cultivation; (c) Plant Clinic Activities (d) Seed/Nursery Production; (e) Food Processing & Preservation; and (f) Biotechnological Tools in Crop Improvement (g) Soil Testing . Students will also attend 4-week off-campus training in different elective-wise activities. During the last week of the training, the students will submit the report whose evaluation will be done by the concerned teachers on the basis of their performance in orientation, village attachment, on and off-campus training.