

SYLLABUS – GENERAL AGRICULTURE

Current scenario of Agriculture in world, India and Karnataka

BCM 111 Plant Biochemistry (1+1)

Theory: Biochemistry-Introduction and importance, Plant cell-Structure and organellar functions. Biomolecules–Structure, properties and reactions: amino acids, peptides and proteins, lipids, carbohydrates, nucleotides and nucleic acids. Enzymes- Factors affecting the activities, classifications, immobilization and other industrial applications. Metabolism – Basic concepts. glycolysis, citric acid cycle, pentose phosphate pathway, α -oxidation of fatty acids, electron transport and oxidative phosphorylation. General reactions of amino acids degradation. Metabolic regulation. Secondary metabolites- terpenoids, alkaloids, phenolics.

CSC 111 Computer Science and Agri-informatics (1+1)

Theory: Introduction to Computers, organization and architecture of Computers, Memory Concepts, Units of Memory, Operating System, definition and UNIX, WINDOWS. Basic Computer networks, Internet and World Wide Web (WWW), Editing and Formatting a document, Database, concepts and types, creating database. Introduction to Computer C-Programming language, concepts and standard input/output operations. Introduction to ICT and uses in agriculture. Introduction to Computer-controlled devices (automated systems) for Agri-input management, Smartphone apps in Agriculture. Introduction to Bioinformatics and Omics database NCBI, searching and accessing genome sequences and protein sequences. Introduction to GIS and its applications in Agriculture. Introduction to MIS and Decision Support System and its applications in Agriculture.

ENG 111 Comprehension and Communication Skills in English (1+1)

Theory: Reading Comprehension, Vocabulary- Antonym, Synonym, Homophones, Homonyms, often confused words. Exercises to help the students in the enrichment of vocabulary based on TOEFL and other competitive examinations. Functional grammar: Articles, Prepositions, Verb, Subject verb Agreement, Transformation, Synthesis, Direct and Indirect Narration. Writing Skills: Paragraph writing, Précis writing, Report writing, Proposal writing and Letter Writing. Interview Skills. Resume/CV Preparation and Job applications. Synopsis Writing.

AST 221 Agricultural Statistics (2+1)

Theory: Introduction to Statistics and its Applications in Agriculture, Classification & Frequency Distributions of data, Diagrammatic Representation of Data: Bar & Pie diagrams, Graphical Representations of Data: Histogram, Frequency Polygon, Frequency curve and Cumulative frequency curve (Ogives). Measures of Central Tendency: Concepts & Definition, Characteristics of ideal Average, Arithmetic Mean, Median, Mode, Quartiles, Deciles & Percentiles (both for Ungrouped and Grouped data), Geometric Mean and Harmonic Mean (Ungrouped data). Measures of Dispersion: Concepts & Definition, Types of Measures of Dispersion: Range, Quartile deviation, Absolute Mean Deviation from mean and median, Standard Deviation and Variance, and Co-efficient of dispersion (both for Ungrouped and Grouped data). Moments, Measures of Skewness and Kurtosis (both for Ungrouped and Grouped data). Concept of Set Theory: , Permutation & Combinations. Theory: of Probability: Concept & Definition, Addition and Multiplication rules (without proof). Theoretical Probability distributions: Binomial, Poisson and Normal Distribution, their Properties & Applications.

Simple Correlation Analysis: Definition, Measures of Correlation: Scatter diagram, Karl Pearson product moment and Spearman's rank correlation coefficients and their properties. Simple Linear

Regression Analysis: Definition, Fitting of simple linear regression equations Y on X and X on Y, Properties of regression coefficient, interrelation between correlation and regression.

Introduction to Sampling Theory: , Sampling versus Complete Enumeration, Methods of Sampling, Type of Sampling- Simple Random Sampling (with and without replacement), Use of Random Number Tables for selection of Simple Random Sample, Concept of Sampling distribution and standard error, concept of systematic, stratified and cluster sampling along with their advantage & disadvantages.

Test of Significance: Introduction, Null & Alternative hypothesis, Types of Errors, Level of significance, degrees of freedom, Critical & Acceptance regions. Large sample tests: Z-Test for Means – One and Two sample Means for Known and Unknown population variance. Small sample test: Student t-test for Means - One and Two sample means, Paired t-test and F-test for two population variances. Chi-Square test: Test for Goodness of Fit, Test for independence of attributes for $r \times c$ contingency table, 2×2 contingency table with Yates correction, and test for single population variance.

Introduction to Analysis of Variance and its Assumptions, Analysis of Variance for One & Two Way Classification. Concept of design of experiments: Basic Principle of Experimental Design: Randomization, Replication & Local control, Basic Designs: CRD, RCBD and LSD, their advantages and disadvantages.

AGR 111 Fundamentals of Agronomy (2+1)

Theory: Agronomy and its scope, Agriculture as an art, science and business of crop production, Factors affecting crop production, History of agriculture development in India and Karnataka,

Importance and scope of agriculture, classification of crops, Seeds and sowing, Soil and its components, properties, fertility and productivity and their management, Tillage and till, Crop density and geometry, Crop nutrition - manures and fertilizers, nutrient use efficiency, Growth and development of crops, ideotypes, Cropping systems and its principles, Crop adaptation and distribution, crop management technologies in problematic areas, Harvesting and threshing of crops. Weeds- importance, classification, crop weed competition, concepts of weed management-principles and methods, herbicides- classification, selectivity and resistance, allelopathy.

AGR 121 Water Management (1+1)

Theory: Definition of irrigation, water resources; soil water relations; Basic terms in water management and irrigation. Study of soil moisture constants and hydrodynamic relation. Measurement of soil moisture-direct and indirect methods; Expression of soil moisture and their mutual relations, Plant water relationship –critical stages. Meaning and impact of water stress, water availability and its relationship with nutrient availability and losses. Water management of crops – its definition, meaning, measurement and relevance in crop production, concept of evapotranspiration and its management, factors affecting water management, study of water requirement of field and horticultural crops, methods of irrigation – surface, subsurface, sprinkler and drip, constraints and advantages of different methods. Efficiency of irrigation and methods to measure them, Quantitative estimation of irrigation water – direct and indirect methods, Expression of flowing water and mutual relations, Concept of water use efficiency and methods to improve water use efficiency, Assessment of irrigation requirement, Scheduling of irrigation –

Approaches and methods, Suitability of water for irrigation, Concept of drainage and methods.

AGR 122 Introductory Agrometeorology & Climate Change (1+1)

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

AGR 211 Crop Production Technology-I (2+1)

Theory: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops. Cereals – rice, maize, wheat, sorghum, pearl millet and finger millet, Nutrimillets/small millets: kodo millet, foxtail millet, Proso millet, little millet, baranyard millet Pulses- chickpea, peas, pigeonpea, mungbean, urdbean, cowpea, horsegram and lentil; Forage crops: sorghum, cowpea, cluster bean, napier, berseem, lucerne and oat.

AGR 221 Crop Production Technology-II (1+1)

Theory: Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of oilseed crops- groundnut, sunflower, rapeseed and mustard, soybean, sesamum, niger, safflower, castor, linseed, Commercial crops – sugarcane, cotton, jute, mesta.

AGR 321 Farming Systems, Organic Farming and Precision Agriculture (2+1)

Theory: Farming System-scope, importance and concept, Types and systems of farming system and factors affecting types of farming, Farming system components and their maintenance, Cropping system and pattern, multiple cropping system, Efficient cropping system and their evaluation, Allied enterprises and their importance, Tools for determining production and efficiencies in cropping and farming system; Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background, objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment, Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease

and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products. Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture. Global Positioning System (GPS) Geographic Information System (GIS). Site Specific Nutrient Management (SSNM) for nutrient and irrigation management practices. Comparative yield, quality and farm profits under SSM practices v/s Variable Rate Technology (VRT) practices.

AGR 322 Rainfed Agriculture and Watershed Management (1+1)

Theory: Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rainfed agriculture in India ; Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio- morphological characteristics of the plants, Crop adaptation and mitigation to drought; Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions, Concept, objective, principles and components of watershed management, factors affecting watershed management.

AEC 111 Fundamentals of Agricultural Economics (2+0)

Theory: *Economics:* Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic Theory: ; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. **Technical change and types**, Agricultural planning and development in the country. **Land reforms: meaning of land tenure, land tenancy, land reform measures – abolition of intermediaries, tenancy reforms, fixation of ceiling on landholdings, consolidation of holdings, development of cooperative farming. Agricultural labour and farm mechanization.** Demand: meaning, law of demand, demand schedule and demand curve, determinants, utility Theory: law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. Production: process, creation of utility, factors of production, laws of returns and returns to scale. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Distribution Theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. **National income:** Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation. Banking: Role in modern economy, Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. **Tax:** meaning, direct and indirect taxes, agricultural taxation, VAT. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning, *NITI Ayoga*.

AEC 121 Agricultural Finance & Co-operation (1+1)

Theory: Agricultural Finance - meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 3 R'S and 5 C'S of credits Loan repayment plans. Sources of agricultural finance: institutional and non-institutional sources, types of banks, functions of commercial and central bank, credit creation policy, social control and nationalization of commercial banks, micro financing including KCC and SHGs. Lead bank scheme, RRBs, Scale of finance and unit cost. Introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit

Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit-Banking reforms and their implication on agricultural credit – Narasimham Committee and other reports. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports-Time value of money, capital budgeting techniques – PBP, ARR, NPV, BCR, IRR, Bank norms – SWOT analysis.

Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India - credit, multi-purpose cooperatives, farmers' service cooperative societies, role of ICA, NCUI, NCDC.

AEC 311 Agricultural Marketing, Trade and Prices (2+1)

Theory: Agricultural Marketing: Concepts and definitions of market, marketing, agricultural marketing, market structure, marketing mix and market segmentation, classification and characteristics of agricultural markets; studying the problems of marketing-Functional, institutional, commodity and behavioural approaches, Market forces – Demand and Supply, Consumer surplus and producer surplus, nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agricultural commodities; product life cycle (PLC) and competitive strategies: Meaning and stages in PLC; characteristics of PLC; strategies in different stages of PLC; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; Price determination under different types of markets, market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (AGMARK); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration,

efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing and market regulation, Market research- information and intelligence, Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India, NAFED Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; need for agricultural price policy; Administered Prices, CACP, MSP, MIS, Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agricultural commodities;

GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR. Quality control, HACCP, Eco-mark, Agri-export zones, Export-import bank of India.

AEC 321 Farm Management, Production and Resource Economics (1+1)

Theory: Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: **Differences between farm management and production economics**, concept of production function and its type - **Linear, quadratic, Cobb Douglas models, meaning and interpretation**. Uses of production function in decision making, **Laws of returns: Law of variable proportions (factor product)**, factor-factor and product-product relationships, law of equimarginal returns, principle of opportunity cost, law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, **fixed costs, sunken costs, valuation and depreciation of farm assets**, total and average cost curves in the short and long run and farm management cost concepts (CACP), Concept and estimation- gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises.

Discounted Cash Flow Measures and their role in financial evaluation, equipping farmer as decision maker – production, strategic decisions etc., Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, **single entry and double entry book keeping**, farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting, linear programming, appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty in farming, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance schemes – weather based crop insurance, features, determinants of compensation, PMFBY.

Concepts of resource economics, **Significance of NRE in farming**, differences between NRE and agricultural economics, **unique properties of natural resources - land, surface water, groundwater, environment, biodiversity, ecosystem services: uniqueness, indispensability, irreversibility, invisibility, remoteness, intricacy, synergy, ambiguous property rights, externalities, market failure, free riding, property rights**. Positive and negative externalities in agriculture, inefficiency and welfare loss, internalization of externalities, important issues in economics and management of common property resources of land, water, **pasture, fishery and forest resources etc.**

AEG 111 Introductory Soil and Water Conservation Engineering (1+1)

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

AEG 211 Farm Machinery and Power (1+1)

Theory: Status of Farm Power in India, Sources of Farm Power, I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines, Study of different components of I.C. engine, I.C. engine terminology and solved problems, Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication, fuel

supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor, Tractor types, Cost analysis of tractor power and attached implement, Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations, Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment.

AEG 221 Renewable Energy and Green Technology (1+1)

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

AEG 321 Protected Cultivation and Secondary Agriculture (1+1)

Theory:

Green house technology: Introduction, Types of Green Houses; Plant response to Greenhouse environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes. Green house equipments, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis.

Important Engineering properties such as physical, thermal and aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Drying and dehydration; moisture measurement, EMC, drying theory, various drying method, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, re-circulatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

AET 121 Fundamentals of Entomology (2+1)

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

AET 211 Insect Ecology, Principles of Pest Management and Natural Enemies (2+1)

Theory: Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors – temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agroecosystem. Categories of insect pests, IPM: Introduction, history, importance,

concepts, principles and tools of IPM. Economic importance of insect pests and pest risk analysis. Methods of detection and diagnosis of insect pest. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests management. Survey surveillance and forecasting of Insect pest. Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest). Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Study of insecticides including mode of actions, formulations. Pest resurgence and insecticide resistance. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance.

AET 221 Insect Pests of Horticultural Crops and their Management (1+1)

Theory: General account on nature and types of damage by different arthropod pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and control practices for other important arthropod pests of various vegetable crops, fruit crops, plantation crops, ornamental crops, narcotics, flowers, spices and condiments. Pest of crops grown under protected cultivation. Pests of tuber crops, important vectors of plant diseases of horticultural crops.

AET 311 Insect Pests of Field Crops & Stored Grains and their Management (1+1)

Theory: General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics, nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various field crops, Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain. Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management. Important vectors of plant diseases of field crops.

AEX 121 Fundamentals of Agricultural Extension Education and Rural Development (1+1)

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

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Development-meaning, definition, concept & principles, Philosophy of C.D.

Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation:

concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel.

AEX 211 Communication and Diffusion of Agricultural Innovations (1+1)

Theory: Communication: meaning and definition; Principles and Functions of Communication. Models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption. Extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies. Diffusion and Adoption of Innovations – Meaning, Definition, Models and 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 of farmers, farm women and Rural youth – FTC and KVK.

AEX 321 Entrepreneurship Development and Business Communication (1+1)

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

AMB 111 Fundamentals of Microbiology (1+1)

Theory: Origin and evolution of Microbial life. Brief history of microbiology. Microscopes and microscopy. Overview of cell structure of prokaryotes and eukaryotes. General properties of viruses, overview of plant, animal and bacterial viruses, viroids and prions. Different groups of Microorganisms- Bacteria, Fungi, Algae and Protozoa. Microbial nutrition and culture media. Overview of microbial metabolism: glycolysis, citric acid cycle, anaerobic respiration, photosynthesis and fermentation. Microbial growth – measurement of growth, effect of environmental factors on growth. Qualitative and quantitative methods for the study of microorganisms. Microbial genetics: genetic recombination, conjugation, transformation, transduction, mutation and mutants, plasmids, transposons and insertion sequences, cloning vectors. Control of microbial growth: heat sterilization, radiation sterilization, filter sterilization, chemical growth control, disinfectants, antiseptics and antibiotics. Microbial ecology- Microorganisms in nature and their interaction, methods in microbial ecology, Microbial interactions with higher organisms – plants and animals. Concepts of Immunology - Cells and organs of immune system, antigen- antibody reactions, types of immunity, polyclonal and monoclonal antibodies.

AMB 221 Soil and Applied Microbiology (1+1)

Theory: Occurrence and distribution of microorganisms in nature. Soil as a habitat for microbes. Soil microorganisms - bacteria, fungi, algae, protozoa and viruses. Soil enzymes. Role of microorganisms in biogeochemical cycles of carbon, nitrogen, potassium, phosphorus, sulphur and secondary and tertiary nutrients. Soil biotechnology - utilization of microorganisms in improving soil productivity. Microbial interactions - neutralism,

commensalism, synergism, mutualism, competition, amensalism, parasitism and predation. Plant microbe interactions and their biotechnological implications, rhizosphere microflora, symbiotic and free living nitrogen fixing microorganisms, ectomycorrhizal and endomycorrhizal associations. Microbiology of hydrosphere and atmosphere. Microorganisms associated with animals and insects. Potentials and limitations of using microorganisms as agents of biological control of insect pests and diseases. Pesticide micro-flora interactions. Biodegradation, bioconversion of industrial, domestic and agricultural wastes. Industrial use of microorganisms - biochemical processes involved and biotechnological applications. Microbiology of milk and milk products. Single cell protein. Role of microorganisms in biochemical transformation of raw and processed foods. Food spoilage, food poisoning and food borne infections. Principles and methods of Food preservation.

ASC 311 Livestock, Poultry & Fish Production Management (2+1)

Theory: Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Broiler production. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and poultry. Improvement of farm animals and poultry. Importance of Indigenous Live stock and poultry species. Feeding principles of livestock and poultry. Feed ingredients. Feed supplements and additives for livestock and poultry ration. Study of livestock and poultry diseases. Prevention, vaccination schedule and control of important diseases of livestock and poultry. Marketing and Economics of livestock and poultry. Fisheries resources of India. Importance of Inland fisheries. Important fishes and their production. New vistas in Inland fish production.

API 311 Introduction to Apiculture (1+1)

Theory: : Importance of Bees and Beekeeping, History and Development of Beekeeping; Species of honeybees and their colony structure; Morphology of honeybees; Anatomy of honeybees – Digestive, reproductive, nervous, Circulatory and Glandular system; Colony organization; Bee biology; Caste determination in honeybees; Age related activities of workers; Nest architecture; Behaviors in honeybees- Foraging, Communication, Robbing, Swarming and

Homeostasis; How, when and where to start beekeeping; Bee flora; Seasonal management of bee colonies; Management of Robbing, Swarming and Queenless colonies; Uniting and division of honeybee colonies; Queen rearing; Bees as pollinators and pollination management; Pests and Diseases of bees and their management; Hive products – Honey, Bee pollen, Bee wax, Propolis, Bee venom, Royal jelly and their extraction, processing, properties and uses; Poisoning of bees and its prevention; Economics of beekeeping.

CPH 211 Fundamentals of Crop Physiology (2+1)

Theory:

Introduction: Importance of physiology in agriculture.

Plant-water relations: Structure, properties and functions of water; concept of diffusion, osmosis and water potential;

Water balance of plants: Water in soil; Water absorption and translocation in plant; soil-plant-atmosphere continuum; Theories explaining water translocation.

Transpiration: Significance of Transpiration; transpiration in relation to crop productivity, Stomatal physiology, Concept of water use efficiency.

Mineral Nutrition: Importance of plant nutrients; Classification of plant nutrients; Nutrient uptake- Soil, root and microbes interaction, Microbial association for improved uptake of

nutrients; Functions of plant nutrients- Deficiency and toxicity symptoms of plant nutrients; Hydroponics, aeroponics. Mechanism of ion absorption and translocation. Membrane transporters and carriers.

Photosynthesis: Mechanism of carbon fixation by C₃, C₄ and CAM pathway and their significance; Plant responses to elevated CO₂/climate change; Relation of photosynthesis and crop productivity; Starch and sucrose synthesis; Translocation of assimilates; Source and sink concept; Photorespiration; Factors affecting photosynthesis and productivity; Dry matter partitioning; Harvest index of crops.

Respiration: Significance; Respiratory metabolism, Alternative respiration, Factors regulating respiratory rates.

Plant Growth and Development: Concept of plant growth and morphogenesis; Growth and yield parameters and their measurements; Hormones and plant growth regulators in modulating crop growth; Physiological importance of Auxins, GA, Cytokinin, ABA, Ethylene, Brassinosteroids and strigolactones; biosynthesis and mode of action of plant hormones; applications of growth regulators in agriculture, horticulture and industry.

Photoperiodism and vernalization: Basic concepts and their relevance in crop productivity; Phytochromes and their role.

Seed dormancy and viability: Basic concepts, seed germination and seedling vigour.

Stress Physiology: Plant responses to abiotic stresses; key concepts and definition; acclimation and adaptation mechanisms.

CPH 221 Applied Plant Physiology and Crop Modeling (1+1)

Theory

Application of growth regulators in agriculture/ horticulture/forestry/industry: Effect of growth regulators on important plant growth and developmental processes. Synthetic growth regulators - classification and their effect on plant growth and development. Practical utility of application of plant growth regulators on farm.

Physiological basis of commercial micro propagation: Micro-propagation techniques and its application specific to growth modulation. Macro-propagation techniques including clonal multiplication of elite material. Haploids in crop improvement.

Mineral nutrition: Foliar/ soil application of nutrients to correct the deficiency symptoms. Bio-fortification of micronutrients and their importance in human health.

Herbicide physiology: Classification and mode of action of herbicide and their applications. Development of herbicide tolerant crops.

Post-harvest physiology: Physiological and biochemical changes during fruit ripening and storage. Senescence and post-harvest shelf life of cut flowers, vegetables and fruits. Hormonal and chemical control of post-harvest deterioration of fruits, vegetables and cut flowers and its significance in storage and transport.

Seed physiology: Methods to break seed/ bud dormancy of important agriculture/ horticulture plants. Seed priming/ seed encapsulation techniques to improve seed germination and seedling vigour in important agriculture crops.

Drought mitigation strategies: Mechanism of drought adaptations. Plant traits linked to drought adaptation. Antitranspirants and their applications in agriculture, water holding polymers and their relevance

Crop modeling: Physiological yield models, plant ideotypes.

FSN 111 Principles of Foods Science & Nutrition (2+0)

Theory: Concepts of Food Science (definitions, measurements, density, phase, change, pH, Osmosis, Surface tension, colloidal systems etc.): Food composition and chemistry (water,

carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions): Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.); Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/modified diets, Menu planning, New Trends in food science and nutrition.

FSN 321 Food Processing, Food Safety Standards and Value Addition (1+1)

Theory: : Status of food processing in India. Food processing and distinctive features of food commodities. Primary, secondary and tertiary processing. Processing of -cereals, legumes, fats and oilseeds, fruits and vegetables, milk. Role of additives in value addition, packaging and labeling. Food Safety- Definition, Importance, Scope and Factors affecting food safety, health risks, Types of hazards: Biological, Chemical, Physical hazards. Food storage, Hygiene and Sanitation. Sources of contamination and their control. Personal Hygiene. Food Safety management tools- basic concepts, PRPs, GHPs, GMPs, SSOPs etc. HACCP, ISO series and TQM. Food laws and Standards-Indian Food Regulatory Regime, FSSAI, Global Scenario-CAC, BIS, AGMARK.

GPB 121 Fundamentals of Cytogenetics (1+1)

Theory: Ultra structure of cell, cell organelles and their functions, structure of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes, chromosomal theory of inheritance cell cycle and cell division- mitosis and meiosis and their significance. DNA: types, structure, replication, function, RNA: structure, types and function, life cycle of angiosperms: megasporogenesis and microsporogenesis and fertilization, structural and numerical variations in chromosome and their implications.

GPB 211 Fundamentals of Genetics (1+1)

Theory: Pre-and Post-mendelian concepts of heredity, Mendelian principles of heredity. Probability and -Chi-square. Types of dominance, epistatic interactions with examples. Multiple alleles, pleiotropism, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Mutation, classification, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, cytoplasmic inheritance. Protein synthesis, Transcription and translational mechanism of genetic material, gene concept: gene structure, function and regulation, Lac and Trptophan operons.

GPB 221 Fundamentals of Plant Breeding (2+1)

Theory: Definition, history, objectives and accomplishments of plant breeding, modes of reproduction-its relevance on genetic consequences, breeding methods and cultivar options and its of plant breeding, pollination control systems-self-incompatibility and male sterility. Domestication, Acclimatization and Introduction; Centers of origin/diversity, **Plant genetic resources, their conservation and utilization, genetic** basis and breeding methods in self-pollinated crops - mass and pure line selection, components of genetic variation; heritability and genetic advance; hybridization techniques and handling of segregating populations; multiline concept, concepts of population genetics and Hardy-Weinberg Law, Genetic basis and methods of breeding cross pollinated crops, modes of selection; Population improvement

methods- Ear to row method, modified Ear to Row, recurrent selection schemes; heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties; Breeding methods in asexually propagated crops, clonal selection and hybridization;; wide hybridization and pre-breeding; polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses; Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights.

GPB 311 Crop Breeding (1+1)

Theory:Centers of origin, distribution of species, wild relatives and major breeding objectives and procedures including conventional and modern innovative approaches for development of varieties and hybrids for improved yield, adaptability, stability, biotic and abiotic stress tolerance and quality (physical, chemical and nutritional) of different cereals-rice, wheat, maize, sorghum, bajra and ragi; pulses-redgram, bengal gram, blackgram, chickpea, soybean; oilseeds sunflower, niger, groundnut, sesame, castor, rapeseed and mustard, fibre crops- jute and cotton; cash crops- sugarcane, potato and tobacco.

GPB 321 Intellectual Property Rights (1+0)

Theory: Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Geographical indications, Trade secrets. Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, Patent search and patent database. Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeder's rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features access and benefit sharing.

HRT 121 Fundamentals of Horticulture and Fruit Crops Production (1+1)

Theory: Horticulture - Definition and branches, Importance and scope, Classification of horticultural crops; Plant propagation - methods and propagating structures; Principles of orchard

establishment; Principles and methods of training and pruning; Unfruitfulness; Pollination, pollinizers and pollinators; Fertilization and Parthenocarpy; Importance of plant bio-regulators in horticulture; Importance of rootstocks; Origin, distribution, uses, area and production, soil and climatic requirements, commercial varieties/ hybrids, planting methods, nutrition, irrigation, weed management, pruning and training, inter and mixed cropping, harvesting and yield of Mango, Banana, Citrus, Grapes, Guava, Papaya, Sapota, Pineapple, Pomegranate and Jackfruit.

HRT 211 Production Technology of Vegetable Crops (1+1)

Theory: Importance of vegetables in human nutrition and national economy; Kitchen gardening; Origin, distribution, uses, area and production, soil and climatic requirements, commercial varieties / hybrids, time of sowing, transplanting techniques, planting distance,

fertilizer requirements, irrigation, weed management, physiological disorders, harvesting and yield of Potato, Tomato, Brinjal, Chilli, Capsicum, Cucumber, Watermelon, Ridge gourd, Bitter gourd, French bean, Cabbage, Cauliflower, Onion, Garlic, Carrot, Radish, Palak, Amaranthus, and Drumstick. Protected cultivation of Capsicum and European Cucumber.

HRT 221 Production Technology of Flower Crops and Landscaping (1+1)

Theory: Importance and scope of flower crops; Classification of ornamental plants Principles of landscaping; Garden features and adornments; Garden styles and designs, Lawn and its maintenance; Protected cultivation of Rose, Gerbera, Carnation, Anthurium and Orchids; Open cultivation of Gladiolus, Tuberose, Chrysanthemum, Marigold, Jasmine, Aster and Crossandra.

HRT 311 Production Technology of Plantation Crops, Spices, Medicinal and Aromatic Plants (1+1)

Theory: Origin, distribution, uses, area and production, soil and climatic requirements, commercial varieties, planting methods, nutrition, irrigation, weed management, inter and mixed cropping, harvesting and yield of Coconut, Arecanut, Cashew, Tea, Coffee, Rubber, Pepper, Cardamom, Ginger, Turmeric, Coriander and Fenugreek Ashwagandha, Aloe, Periwinkle, stevia, Mints, Lemongrass, Ocimum, Patchouli and Geranium.

HRT 321 Post Harvest Management and Value Addition of Fruits and Vegetables (1+1)

Theory: Importance of post-harvest processing of fruits and vegetables; Extent and possible causes of post-harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, Cold storage, CA, MA and Hypobaric); Value addition concept; Principles and methods of preservation; Minimal processing; Intermediate moisture foods- Jam, Jelly, Marmalade – Concepts and Standards; Fermented and non-fermented beverages; Drying/ Dehydration of fruits and vegetables – Concept and methods; Canning – Concepts and Standards, Packaging of products.

PBT 121 Fundamentals of Plant Biotechnology (2+1)

Theory: Concept of Plant Biotechnology – History of Plant Tissue Culture and Plant Genetic Engineering; Scope and importance in Crop Improvement – Totipotency and Morphogenesis, Nutritional requirements of *in-vitro* cultures; Techniques of *in-vitro* cultures; Micro-propagation, Anther culture, Pollen culture, Ovule culture, Embryo culture, Endosperm Culture and its applications. 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. Marker-assisted selection and its recent advances.

PAT 211 Fundamentals of Plant Pathology (2+1)

Theory: Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Cause and classification of plant diseases. Important plant pathogenic organisms, fungi, bacteria, fastidious vascular bacteria, phytoplasmas, spiroplasmas, viruses, viroids,

algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic agents. Fungi: general characters, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Binomial system of nomenclature, rules of nomenclature. Classification of fungi, keys to phylum, classes, order and families. Bacteria and mollicutes: general morphological characters. Basic methods of classification and reproduction. Keys to major plant pathogenic bacterial genera. Viruses: nature, morphology, replication and transmission and classification of plant viruses. Keys to important plant virus families / genera. Nematodes: General morphology and reproduction, classification, keys to important plant pathogenic nematode genera, symptoms and nature of damage caused by plant nematodes. Phanerogamic plant parasites: Common characteristic of important parasites, disease development, survival and spread. Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenicity: phenomenon of host infection by Fungi, Bacteria, Viruses, molicutes and nematodes. Pathogenesis: Penetration and colonization. Role of enzymes, toxins and growth regulators in disease development and their classification. Introduction to principles of plant disease management.

PAT 221 Principles of Plant Disease Management (1+1)

Theory: Defence mechanism in plants: structural, biochemical (pre and post-infection) and host plant resistances. Effect of pathogens on plant physiological processes viz., photosynthesis, respiration, translocation and transcription. Epidemiology: Epidemics and factors affecting disease development, patterns of epidemics and disease progress curves. Assessment of disease severity and crop losses. Survey, surveillance, remote sensing and forecasting of plant diseases. Principles and methods of plant disease management: *Avoidance of the pathogen*: Choice of geographical area, selection of field and planting stock etc., *Exclusion of inoculum*: Plant quarantine regulations and inspections, post entry quarantine. *Eradication of the pathogen*: Cultural and physical methods of eradication and inoculum reduction; Biological methods of disease control: Crop rotation, use of trap crops, plant and plant products, use of biological control agents, mechanisms of biocontrol, cross protection. Breeding for disease resistance: Types of resistance, Development of resistant varieties, Induced resistance. Biotechnological approaches of diseases management. IPR and related issues. Chemical methods; nature, chemical combination, classification, mode of action and formulations of fungicides, bactericides, nematicides and antibiotics. Methods of application of chemicals. Insect vector management. Diagnosis of plant diseases. Seed pathology; importance of seed health to man and animals. seed borne nature of pathogens; Identification and detection of seed borne pathogens. IDM: Introduction, history, importance & concepts. Economic importance diseases. Epidemiology and crop loss assessment methods with case studies. IDM module for important cereal (Rice), pulse (pigeon Pea), oil seeds (Sunflower and Groundnut) and vegetable (Tomato and Potato) and horticulture/plantation crops.

PAT 311 Diseases of Field Crops and their Management (2+1)

Theory: Diseases of cereals, millets, pulses, oil seeds and cash crops with respect to economic importance, incidence, symptoms, etiology, disease cycle/life cycle and management practices. **Cereals and Millets:** Rice, Sorghum, Maize, Wheat, Bajra, Navane, & Ragi. **Pulses:** Pigeon pea, Chickpea, Blackgram and Greengram, Cowpea, & Soybean. **Oilseed crops:** Groundnut, Sunflower, Sesamum, Safflower, Mustard, Linseed, & Castor. **Cash crops:** Sugarcane, Cotton, Tobacco, Chilli, Ginger, Turmeric, & Mulberry. Important post-harvest diseases of field crops.

PAT 321 Diseases of Horticultural Crops and their Management (1+1)

Theory: Diseases of fruit crops, plantation crops, vegetables crops, flower crops, Aromatic and Medicinal plants with respect to economic importance, incidence, symptoms, etiology, disease cycle/life cycle and management practices.

Fruit crops: Mango, Apple, Papaya, Citrus, Guava, Pomegranate, Grapes, Pineapple Sapota, Peach & Banana.

Plantation crops: Coffee, Tea, Rubber, Coconut, Arecanut, Cardamom, Beetle vine, Pepper & Vanilla.

Vegetable crops: Tomato, Potato, Brinjal, Crucifers, Cucurbits, Bhendi, Leafy vegetable diseases, Carrot, Onion, Garlic, Cassava, Beans, Peas & Capsicum.

Flower crops: Rose, Jasmine, Tuberose, Crossandra, Chrysanthemum & Gladioli.

Medicinal and Aromatic crops: Periwinkle, Dioscorea, Solanum, Coleus, Davana, Citronella, Sandle, Geranium & Patchouli. Important post-harvest diseases of horticultural

SST 311 Principles and Practices of Seed Production (1+1)

Theory: Introduction to seed science and technology, seed and its importance. Seed quality – characteristics of quality seeds, factors affecting seed quality and its maintenance. History and development of seed industry, Seed programmes, types, planning and execution. Different classes of seed, generation system of seed multiplication, seed replacement and varietal replacement rates- seed multiplication ratio, seed renewal and seed plan, Agencies involved in seed production at state and national level. Seed certification – control of seed source, field inspection, field counts, field standards. Principles of seed production- genetic, agronomic and economic principles, Maintenance of genetic purity during seed production. Deterioration of crop varieties — factors and their control, Requirements for hybrid seed production and types of hybrids. Systems and techniques of hybrid seed production, male sterility, self-incompatibility, CHA and EGMS. Planning for breeder, foundation, truthfully labelled and certified class of seed production. Seed production- foundation and certified seed production in maize (varieties, hybrids, synthetics and composites); rice, sorghum and bajra (varieties and hybrids); greengram, blackgram, bengalgram, cowpea (varieties); soybean, groundnut (varieties); sunflower (varieties and hybrids); castor (varieties and hybrids); cotton (varieties and hybrids); tomato and brinjal (varieties and hybrids); chilli and bhendi (varieties and hybrids), onion and melons and gourds (varieties and hybrids) and potato (varieties and true potato seeds), seed crop harvesting methods and management; Seed production under protected cultivation. Seed marketing and distribution strategies– organizations, structures, sales, International trade. Export and import policies for seed trade, generation activities, sales promotional media and factors affecting seed marketing. Seed Sales, License, pricing policy, cost benefit ratio, economic feasibility and factors influencing.

SST 321 Post Harvest Seed Technology and Quality Assurance (1+1)

Theory: Introduction and importance of seed quality regulations seed legislations and regulatory measures. Seeds Act (1966), Seed Rules (1968), Seed Control Order (1983), Central Seeds Committee, Central Seed Certification Board, OECD Seed Certification Schemes, State Seed Certification Agency – Central and State Seed Testing Laboratories and their functions, New Seed Policy (1988), The plants, fruits and seeds (regulation of import into India), Order (1989). DUS testing principles and applications, PPV and FRA (2001 and 2003), National Seed Policy (2002) and the Seed Bill (2004). Seed Drying — importance, principles and methods. Psychrometric chart and its use in seed drying process. Seed processing — objectives and principles. Air screen cleaner and its working principles, different upgrading equipments and their use. Seed treatment- importance and types, equipments used for seed treatment, Seed testing — objectives, history, sampling procedures, testing for moisture, physical purity, germination, viability, vigour and seed health. Seed quality regulation systems (Grow out test and molecular markers). GM crop testing. Seed packaging — principles, procedures and types

of containers. Varietal release, notification – seed certification, history, phases and procedures, field inspection, field counts, field and seed standards, Post-harvest inspections and seed quality assurance. Seed storage - general principles, stages, factors affecting seed longevity, conditions

required for safer storage, measures for humidity, moisture and temperature control, mid storage corrections and seed quality enhancement techniques.

SER 321 Introduction to Sericulture (1+1)

Theory: Introduction, origin & history, statistics and distribution of sericulture, Mulberry varieties. Types of silks, Species of silkworms and their host plants. Raising of mulberry saplings, mulberry cultivation practices for irrigated and rainfed conditions, separate chawki garden. Integrated nutrient Management. Pests and diseases of mulberry and their management. Life cycle of silkworms. Morphology and anatomy of *Bombyx mori* L. Commercially exploited breeds of silkworm. Steps in silkworm egg production at grainage, egg sheets and loose egg production technology. Tier system of silkworm seed multiplication, seed area concept. Preservation and handling of eggs, egg incubation. Disinfection and hygiene in silkworm rearing. Silkworm rearing plan, Rearing house plan and equipments. Importance of chawki rearing, chawki rearing centres. Harvesting, transportation and preservation of leaves. Methods of silkworm rearing, shoot feeding, shelf rearing, rearing operations, environmental conditions and their management. Importance of feeding, bed cleaning, spacing, care during moulting. Picking and mounting ripened silkworms. Harvesting of cocoons, grading, cocoon sorting, defective cocoons, and sale of cocoon in silk cocoon markets. Mechanization in sericulture. Pests and diseases of silkworms and their management. Post cocoon technology, Steps in reeling – storage- cocoon drying/stifling, cocoon cooking, brushing, reeling and re- reeling. Different methods of silk reeling. Raw Silk Marketing- Silk Exchange– functions, Silk trade -import-export. Sericulture byproducts and their utilization for additional income. Economics of Sericulture.

SAC 121 Fundamentals of Soil Science (2+1)

Theory : Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil; Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; soil survey, types, methods of soil survey Soil water retention, movement and availability; Soil air, composition, gaseous exchange, problem and plant growth, Soil temperature; source, amount and flow of heat in soil; effect on plant growth, soil organisms: macro and microorganisms, their beneficial and harmful effects.

SAC 211 Soil Chemistry (1+1)

Theory : Soil chemistry- Scope and importance . components of soils – inorganic and organic components. Soil colloids – types properties and significance of soil colloids. Layer silicate claysgenesis, structure and properties. Source of charges – positive and negative charges, electrical double layer – Helmholtz, Gouy – Chapman, stern theories. Ion exchange cation exchange capacity and anion exchange capacity, factors influencing ion exchange and its significance. Soil organic matter – composition, decomposition, fractionation of organic matter, uses; Humus – humic substances, nature and properties ; carbon cycle, C:N ratio; Chemistry of submerged soils.

SAC 311 Problematic Soils and their Management, Geoinformatics (1+1)

Theory: Soil quality and health, Distribution of waste land and problem soils in India. Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; Their

categorization based on properties. Reclamation and management of saline and sodic soils, acidic soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils- Soil pollution-behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Irrigation water – quality and standards, utilization of saline water in agriculture. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-ecosystems. Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping: fertilizer recommendation using geospatial technologies: Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs. Remote sensing and GIS in diagnosis and management of problem soils.

SAC 321 Manures, Fertilizers and Soil Fertility Management (2+1)

Theory : Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management. Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order. History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.
